East Face Vegetation Management Project
Fisheries and Watershed Specialist's Report

Sarah Brandy

La Grande Ranger District Fisheries Biologist

Wallowa-Whitman National Forest

September, 2015

Table of Contents

INTRODUCTION

This report analyzes the effects on fisheries and watershed resources for the proposed **47,636 acre East Face Vegetation Management Project Area** (herein referred to as East Face).

The description of watershed/fisheries resources, along with the analysis of the expected and potential effects for each alternative were assessed using field surveys, water quality databases, supporting literature, and professional judgment.

Several management directives/recommendations apply to this project. The Management directives from the Wallowa-Whitman Land and Resource Management Plan (LRMP) 1990, the Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH 1995); the Interim Strategies for Managing Fish-Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada Inland Native Fish Strategy (INFISH); and the LRMP Biological Opinion (1998) will be followed. In addition, the PACFISH and INFISH amendments add further interim management direction in the form of Riparian Management Objectives (RMOs), Riparian Habitat Conservation Areas (RHCAs), and standards and guidelines.

Five alternatives are analyzed for this project: Alternative 1 (no action) and action alternatives Alternative 2 (proposed action), Alternatives 3, Alternative 4, and Alternative 5. Under Alternative 1 the project would not be implemented and existing conditions would continue. The differences between Alternatives 2-5 are summarized in Table 1.

Common to all action alternatives is:

- Road Decommissioning (Post Sale Road Plan)
- Fish Passage improvement on Wolf Creek Road 4316800 (Culvert replacement)
- Danger Tree Removal
- Invasive Species Treatment
- Forage Enhancement
- Bridge replacement on the 7312 road North Fork Anthony Creek

Objectives of the project are:

- Modifying fire behavior and intensity – also protects recreation facilities and watershed values.
- Creating and maintaining defensible fuel profile zones in strategic areas on Federal lands to compliment fuel reduction activities on private lands, aid future fire suppression efforts, and minimize natural resource impacts in the event of a wildfire.
- Increasing public and firefighter safety while protecting natural resource values in the event of a wildfire.
- Providing for landscape and local connectivity corridors.
- Improving the sustainability of forested stands against insects and disease.
- Accelerating stand structure toward HRVs.
- Enhancing management indicator species forage and security habitat.
- Providing for commercial products, firewood, and employment opportunities for local economies.

- Creating an access and travel management plan for the area which protects resources and provides for recreation and administrative access (including emergency access) in the project area.

Table 1 - Summary of Proposed Actions for Each Alternative.

Alternative Elements		**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Project Area Boundary (PAB) Acres USFS – 46,412 acres Vale BLM – 1,224		0	**47,636**			
Total Harvest/Noncommercial Treatment Acres		**0**	**17,098**	**13,654**	**16,500**	**18,036**
Harvest Treatment Acres (total)		**0**	**6,722**	**3,879**	**2,844**	**10,221**
Total Acres Treated by Prescription Type (Commercial) *HPO includes treatments in HIM/HPO and HTH/HPO units	HFU	0	245	139	155	245
	HIM	0	2,200	1,198	1,255	2,886
	HPO*	0	143	0	0	143
	HPR	0	43	43	38	43
	HSA	0	210	62	122	210
	HSH	0	318	0	120	318
	HTH	0	3,563	2,437	1,154	3,816
	WFH- Biomass Removal	0	0	0	0	391
	PCT- Biomass Removal	0	0	0	0	2,169
Noncommercial Treatments		**0**	**10,376**	**9,775**	**13,656**	**7,815**
Total Acres Treated by Prescription Type (Noncommercial)	PCT	0	3,447	3,372	6,682	1,277
	WFH	0	5,184	4,658	5,184	4,793
	WFM	0	1,745	1,745	1,700	1,745
	FFU	0	0	0	90	0
Post-Treatment Activities						
Post-Treatment Activities (Acres)	Precommercial Thinning	0	195	116	26	195
	Grapple Pile/Slashbuster	0	10,704	6,842	8,568	8,083
	Handpile & Burn	0	2,102	3,090	4,099	3,929
	Planting	0	461	0	129	461
	Whipfelling	0	6,682	3,879	2,834	7,621
	Burning for Site Preparation	0	127	0	26	127

Alternative Elements		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	Jackpot Burn	0	3,835	2,820	2,823	4,150
Prescribed Fire (Acres)	Total Burn Block Area	0	6,685	6,043	6,643	6,685
Treatments within RHCAs (Acres)	Precommercial Thinning Treatments	0	238	225	238	45
	Hand Fuel Reduction Treatments	0	754	612	754	746
Yarding Systems (Acres)	Ground Based	0	5,295	3,239	2,092	8,350
	Skyline	0	1,094	416	419	1,450
	Helicopter	0	333	224	333	421
Road Work (Miles)	Reconstruction	0	53	39.3	27.8	61.6
	Temporary Roads - Total Miles on Existing Miles of New	0	12.62 6.01 6.61	0	2.62 0.67 1.95	14.71 6.57 8.14
	Miles of Closed Roads Opened	0	107	66.9	38.6	122.7
Enhancement/Safety Work	Danger Tree Removal	No	Yes	Yes	Yes	Yes
	Culvert Replacement for Fish Passage	No	Yes	Yes	Yes	Yes
Harvest Volume in million board feet (MMBF)	Sawtimber Volume	0	16.4	9.3	6.6	18.8
	Non-Saw Volume	0	5.5	3.2	2.4	7.5
	Total Volume (MMBF)	0	21.9	12.5	9.0	26.3

Treatment Descriptions

COMMERCIAL FUELS REDUCTION AND VEGETATION MANAGEMENT TREATMENTS

Sanitation harvest (HSA) prescription is designed to remove diseased and insect damaged trees and associated trees with a high potential to become infected. The trees to be removed with this prescription in East Face are a mix of Douglas-fir and western larch with mistletoe. The treatment will remove those trees with multiple mistletoe brooms and reduce the incidence of future mistletoe. The objective in these stands will be to promote non-susceptible species in the understory. For example, in stands with Douglas-fir mistletoe treatments will promote ponderosa pine and western larch.

Thinning harvest (HTH) prescription is designed to stimulate the growth of the desired residual trees.

Shelterwood harvest (HSH) prescriptions in which a stand of trees is established through a series of cuttings designed to facilitate establishment of a new cohort of trees. It will also move stands toward more seral species composition. Due to site conditions, scattered overstory trees are retained to provide some shade or site protection for the regenerating stand beneath it and materials for future down wood recruitment.

Partial Removal harvest (HPR) prescription is the partial removal of the overstory over an established understory. Trees retained in the overstory are at levels adequate to meet green tree recruitment needs.

Improvement harvest (HIM) thinning and removal of undesirable trees (poor form, damaged condition, ecologically inappropriate species etc.) within a stand for the purpose of improving the growth, composition and quality of the remaining stand.

Fuels Harvest (HFU) prescription in which trees creating ladder fuels and excess down dead woody material are removed offsite with the use commercial harvest methods.

Patch Openings (HPO) prescriptions treat about 10% of the stand and create holes that will promote early successional structure and early seral species such as western larch, western white pine. The goal of these treatments would be to create some heterogeneity in stands that are predominately even-aged lodgepole with some associated species. Prescription would create small canopy openings (4 to 6 acres) focusing on promoting pine and larch to improve stands resilience to wildfire and insect and disease outbreaks. Most of these stands would also have an intermediate treatment that will be done outside the openings to reduce densities down to approximately 100 trees per acre. Planting would be used in patch openings to supplement natural regeneration and meet stocking requirements where needed.

Biomass Removal (BIO) – is the mechanical removal of non-saw material in non-commercial treatment units for pulp and fiber utilization.

NON-COMMERCIAL FUELS REDUCTION AND VEGETATION MANAGEMENT TREATMENTS

WFH – Fuels Reduction Handwork Only. Treatments are designed to remove ladder fuels and manage understory tree density at appropriate levels using manual methods. Ladder fuels are

defined as trees (less than 9" DBH) growing under the drip line of the dominant and co-dominant trees within the project area. These trees provide a ladder for flames into the crowns of the larger trees increasing the probability for high crown fire. Dead and down fuels would also be piled and burned. RHCAs may be treated as described below.

WFH RHCA - **Fuels Reduction Handwork Only Within RHCAs (no mechanical treatment).** WFH work within RHCAs would be conducted by hand only (no mechanical treatment). Units would receive ladder and ground fuels reduction treatment involving precommercial thinning of live trees less than nine inches dbh to a spacing of 14 by 16 feet using chainsaws. Ladder fuels branches on trees up to six feet above ground would be pruned, and slash would be piled by hand and burned.

For Fuels Reduction work within RHCAs, minimum no activity stream buffers of 10 feet on Class IV streams (intermittent non-fish bearing), 30 feet on Class III streams (perrenial non-fishbearing), and 50 feet on Class I streams (fishbearing) would be implemented. Depending on the amount of slash generated, hand piling and hand burning of slash piles within RHCAs may be required to address fuel accumulations. Small diameter material created from fuels reduction would be hand piled and burned by hand, and would occur outside of no activity stream buffers. All fuels reduction activities within RHCAs would be conducted by hand. Burn piles within RHCAs would be approximately four feet in height and six feet in diameter. All piles would be spaced to avoid damaging or killing overstory trees during burning operations. Piles would be burned when there would be a high soil moisture content and would result in a low intensity burn to minimize effects to soils and vegetation.

WFM – Fuels Reduction Mechanical Pre-commercial sized tree density management followed by a surface fuels reduction using a combination of hand work, mastication (slash busting) or grapple piling where surface fuel loadings exceed 15 tons/acre. Mechanical activities are not allowed within RHCAs.

PCT – Precommercial Thinning. Four types of PCT activities are proposed in this project as described below. Before thinning, PCT units have 500-2,500 stems (trees) per acre. These units would be thinned to 175 to 220 stems (trees) per acre, which is considered to be fully stocked. Manual or mechanical pre-commercial thinning activities would occur resulting in variable spacing (14-20 feet between trees) including retaining approximately 10% of the area in an untreated condition to provide for wildlife habitat needs. Species preference will be western larch, ponderosa pine and Douglas-fir. RHCAs may be treated as described below.

- **PCT Post-harvest –** Thinning clumps of overstocked small diameter trees following commercial harvest activities as described above.
- **PCT Old Harvest Units/areas** – Thinning overstocked small diameter understory trees within historic harvest units within the project area to manage stocking densities and promote stand health, vigor, and sustainability.
- **PCT in Alternative 4** – Non-commercial thinning of overstocked small diameter understory trees for fuels reduction goals without any cutting/removal of overstocked large diameter overstory trees.
- **PCT RHCA - Precommercial Thinning Handwork Only Within RHCAs (no mechanical treatment).** Thinning of overstocked trees < 9 inches dbh, and hand piling and burning of

slash would occur in old harvest units within RHCAs. Trees would be thinned to a 14 by 20 foot variable spacing. Trees are not thinned in a perfect tree farm like grid. Variable spacing and wildlife clumps introduce irregularity into thinning. For precommercial thinning by hand within RHCAs, minimum no activity stream buffers of 10 feet on Class IV streams (intermittent non-fish bearing), 30 feet on Class III streams (perennial non-fishbearing, and 50 feet on Class I streams (fishbearing) would be implemented. Depending on the amount of slash generated, hand piling and hand burning of slash piles within RHCAs may be required to address fuel accumulations. Small diameter material created from precommercial thinning would be hand piled and burned by hand, and would occur outside of minimum no activity stream buffers. No mechanical treatment would be allowed in RHCAs (no slashbuster or grapple piling). All activities within RHCAs would be conducted by hand. Burn piles within RHCAs would be approximately four feet in height and six feet in diameter. All piles would be spaced to avoid damaging or killing overstory trees during burning operations. Piles would be burned when there would be a high soil moisture content and would result in a low intensity burn to minimize effects to soils and vegetation.

Prescribed Fire - Prescribed burning would occur when weather and fuel conditions are appropriate to meet the objectives and prescriptions for each unit. No more than a total of 10 percent of the available forage would be burned per year within the project area. Burning would be accomplished over the next 10 years. Control lines would include roads, natural barriers, brush removal, and mechanical fireline construction. For prescribed fire, with the exception of RHCA treatment units, direct ignition within RHCAs would not be permitted within 300' of Class I streams, 150' of Class III streams, and 50' of Class IV streams. Fire would be allowed to back into all RHCAs.

Mechanical fire lines - Mechanical fire lines (less that 2ft wide) would be constructed between road segments to provide containment lines prior to unit ignition. Burning along private land boundaries would be coordinated with adjacent landowners. All mechanical firelines are outside of RHCAs.

Roadside Hazard Trees - Danger trees (standing trees that present a hazard to people due to conditions such as, but not limited to, deterioration or physical damage to the root system, trunk, stem, or limbs and the direction of the lean of the tree would allow that tree to reach the roadway if it fell) would be cut along all haul roads (approximately 15 trees/mi). If the trees are within RHCAs they would be cut and left on site since there is no mechanical removal from RHCAs. If they are outside of RHCAs or not required to be retained for other resource needs and are of commercial value, they may be removed with this timber sale.

ROAD TREATMENTS

Maintenance of Closed Roads for Administrative Use. Maintenance includes brushing, spot rocking, blading and shaping of the road surface, cross drain culvert cleaning, and limited ditch cleaning. Some closed roads will require installation of culverts and cross drains.

Temporary Roads. Temporary roads would be located in upland areas, RHCAs and draw bottom areas adjacent to streams. Some would utilize existing wheel tracks requiring limited amounts of ground disturbance for use and others would need to be constructed. All temporary roads would be built, used, and restored during the dry season and during the same season of use. All temporary roads proposed for project use in all alternatives would be decommissioned after project activities are

completed. Restoration of temporary roads includes some or all of the following activities: installation of erosion control devices, subsoiling to reduce compaction, returned to original contours where needed, debris scattered across the footprint of the temporary road where debris is available, seeded with native grasses, and camouflaging roads to discourage further use.

Road Reconstruction. Due to limited harvest operations in the area over the past 15-20 years, many roads have become difficult to navigate, have grown in with small trees, or have otherwise become unusable. Some roads have sloughed in, eroded, developed springs in the travelled way, have had culverts removed, or were built and remain in such a primitive state (narrow widths, tight corners) as to render them unsuitable for haul. In all alternatives, there are some roads that are identified for incidental reconstruction or reconstruction-like maintenance of the travelled way. Trees would be felled and stumps grubbed for the road to become passable, but all work would be confined to the existing road template, and no new ground would be disturbed.

The remainder of the road reconstruction would involve improvement of the travelled way to obtain adequate road widths, address drainage problems and resource concerns. Roadbed stabilization, excavation, addition of drainage structures, and placement of pit-run or crushed aggregate surfacing would be accomplished to accommodate vehicular use or to achieve an extended season of haul over routes that are fundamental to the harvest and post- sale operations. Reconstruction activities would utilize material sources from developed sources within the project area.

Bridge Installation. Road 7312 hosts a load-rated bridge across the North Fork Anthony Creek which would be removed and replaced with a bridge adequate to span the length of the crossing and safely support heavy truck traffic.

Road Decommissioning. Roads identified as either duplicate access or no longer needed on the landscape for resource management and recreation access and would be decommissioned, returned to resource production, and removed from the road system. These roads generally have grown in or devolved to such as state as to be impassable, and often have invisible templates. Treatment of these roads would address hydrologic concerns such as reducing sedimentation by providing additional drainage structures such as surface cross drains. These roads differ from project temporary roads as they are not being used for accessing units for vegetation management.

EFFECTS ANALYSIS

Introduction

The watershed resources section analyzes the direct, indirect, and cumulative effects to:

A. Water Quality
B. Fisheries Species and Habitat
C. Aquatic Management Indicator Species (MIS)
D. Threatened and Endangered Fish Species.

Assumptions

The project area is the analysis area for consideration of the direct and indirect effects of implementation of East Face project activities for all watershed resources. The entirety of all of the subwatersheds containing any part of the East Face project area will be the analysis area for cumulative effects for all watershed resources.

Direct effects to water resources are primarily related to sediment input from project actions which occur at the same time and place as watershed resources. Indirect effects are primarily related to sediment and stream temperature impacts which are caused by the action and are later in time or farther removed in distance. Cumulative effects are from present and reasonably foreseeable future actions that overlap in time and space with the effects of the East Face project.

Sediment Delivery Rates - The definition of accelerated sediment delivery for the East Face Project includes any increase over and above the natural sediment rates of the watershed.

INFISH/PACFISH RHCAs have been delineated on all streams within the East Face Project area. These RHCAs are delineated as follows:

- 300 feet on each side of fishbearing streams (600 feet total RHCA width beginning at the edge of the 100 year floodplain)
- 150 feet on each side of non-fishbearing perennial streams (300 feet total RHCA width beginning at the edge of the 100 year floodplain) and wetlands greater than one acre
- 100 feet on each side of non-fishbearing intermittent streams (200 feet total RHCA width) and wetlands less than one acre.

It is difficult to equate soil erosion directly to sedimentation rates. Obstructions in the path (i.e. downed wood, grass/forb cover) between the sediment source and the stream reduce the risk of indirect sediment delivery to the stream. Therefore, adequate filter strips (in terms of size, ground cover and downed material) are necessary to slow or prevent sediment movement downslope of disturbed areas. The use of the riparian buffers described above has long been recognized as a mitigation measure to reduce sediment transport to streams. The structural complexity of roots and herbaceous vegetation, in addition to the absorption capability of the duff layer, limits excess sedimentation to the aquatic system. Surface runoff slows down when it comes in contact with herbaceous shrubs, mature trees and the duff layer on the forest floor and sediment is deposited within the riparian buffer before it reaches the watercourse (Decker 2003).

No Direct, Indirect, or Cumulative Effects

The following activities associated with the East Face Project have been analyzed and are of such limited context and constrained nature that they would have little to no measurable effect on watershed and fisheries resources. These activities and their effects will not be discussed further in this effects analysis.

- Roadside Danger Tree Removal
- Whitebark Pine Treatments

Roadside danger tree removal will only occur outside of RHCAs. Danger trees felled within RHCAs will be left on site. No ground disturbance will occur within RHCAs from this activity, and there will be no potential effects to water quality or fisheries resources.

A. Water Quality

Direct Effects to Water Quality

ALTERNATIVE 1 - NO ACTION

There are no direct effects on water quality as a result of the No Action Alternative. Effects related to this alternative on water quality and stream temperature are primarily indirect in nature and are discussed in the Indirect Effects to Water Quality section.

ALTERNATIVE 2, 3, 4 and 5

The project activities that would have potential of direct effects on water quality are opening closed roads where culvert installation or cleaning of plugged culverts would occur, construction of new temporary roads where culvert installation and removal would occur, instream work associated with the replacement of the culvert on Wolf Creek for fish passage enhancement, and handwork within RHCAs.

Commercial Harvest

All mechanical treatments and commercial removal will occur outside of RHCA buffers and which would prevent direct effects to water quality.

Table 2 - Total Harvest Acres and proposed Logging System Acres

Logging and Systems	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Harvest Treatment Acres-Total	6,722	3,879	2,844	10,221
Skyline yarding	5295	416	419	1,450
Ground based equipment	1,094	3,239	2,092	8,350
Helicopter	333	224	333	421

Total proposed harvest treatment acres and proposed logging systems for Alternatives 2-5 are displayed in Table 2. For Commercial Harvest (HFU, HIM, HPO, HPO, HPR, HSA, HSH, HTH, WFH-BIO, and PCT-BIO units) RHCA buffers will be implemented as no activity stream buffers. RHCA buffer widths would prevent direct effects to water quality from commercial harvest. In skyline units, full suspension over the RHCA is required and will prevent direct effects to water quality. No direct effects to water quality from commercial harvest activities are anticipated in any action alternatives.

Fire Fuels Treatment (FFU)

Only Alternative 4 proposes 90 acres of fuels reduction (FFU units) outside of RHCAs in units 46, 66 and 147. Table 3 below displays the total acres of FFU treatment by subwatershed proposed under Alternative 4. FFU treatments using heavy equipment would occur outside of RHCA buffers only.

Table 3 – Alternative 4 Acres of Fire Fuels Treatment by Subwatershed

Subwatershed	Alternative 4 Acres
Lower Anthony Creek	3
Upper Beaver Creek	29
Upper Wolf Creek	58
TOTAL	**90 Acres**

Fuels reduction outside of RHCAs includes mechanical treatment using a slash buster (mastication) and piling slash with a grapple pile machine. For FFU units RHCA buffer widths would be implemented as minimum no activity stream buffers and would prevent direct effects to water quality from fuels reduction activities outside of RHCAs.

Precommercial Thinning (PCT) – Total acres of PCT treatment by alternative is displayed in Table 4. This includes all four types of PCT activities described on page 2 and the number of PCT acres that are within RHCA buffers.

A total of 3,447 acres of PCT is proposed for Alternative 2, 3,372 for Alternative 3, 6,685 for Alternative 4 and 3,446 for Alternative 5. The majority of proposed precommercial thinning acres will occur outside of RHCA buffers, however some acres of RHCA thinning is proposed in each alternative to improve conditions of riparian stands. See Table 4 for total acres of PCT treatment inside and outside of RHCA buffers by subwatershed.

Outside of RHCAs

Precommercial thinning outside of RHCAs in all action alternatives includes both handwork on slopes >30% and the use of slashbusters (mastication) on slopes <30%. This activity is outside of RHCAs, which will prevent direct effects to water quality in all action alternatives.

Within RHCAs

Alternatives 2 and 4 propose 238 acres of precommercial thinning (PCT units) within RHCAs. Alternative 3 proposes 225 acres of PCT within RHCAs; Alternative 5 proposes 45 acres of PCT within RHCAs. Thinning of overstocked trees < 9 inches dbh, and hand piling and burning of slash would occur in old harvest units within RHCAs. Trees would be thinned to a 14 by 16 foot variable spacing. For precommercial thinning by hand within RHCAs, minimum no activity stream buffers of 10 feet on Class IV streams (intermittent non-fish bearing), 30 feet on Class III streams (perennial non-fishbearing, and 50 feet on Class I streams (fishbearing) would be implemented. Depending on the amount of slash generated, hand piling and hand burning of slash piles within RHCAs outside of minimum no activity stream buffers may be required to address fuel accumulations.

Table 4 - Acres of Precommercial Thinning Inside and Outside of RHCAs by Alternative

Subwatershed/Treatment Type	Alt 2	Alt 3	Alt 4	Alt 5
Jimmy Creek				
PCT	74	74	74	74
PCT RHCA	0	0	0	0
Lower Anthony Creek				
PCT	824	824	1,384	824
PCT RHCA	65	65	65	0
Middle North Powder River				
PCT	297	297	376	297
PCT RHCA	16	16	16	0
Tanner Gulch Grande Ronde				
PCT	64	64	64	64
PCT RHCA	2	2	2	2
Upper Anthony Creek				
PCT	1,239	1,164	1,584	1240
PCT RHCA	123	110	123	20
Upper Beaver Creek				
PCT	<1	<1	1,244	<1
PCT RHCA	0	0	0	0
Upper Ladd Creek				
PCT	218	218	235	218
PCT RHCA	13	13	13	7
Upper Wolf Creek				
PCT	731	731	1,721	731
PCT RHCA	19	19	19	16
Totals				
Total PCT	**3,447**	**3,372**	**6,682**	**3,446**
Total PCT RHCA	**238**	**225**	**238**	**45**

No activity stream buffers would prevent direct effects to water quality because minimum no activity stream buffers would be implemented and no PCT treatments occur on streambanks or in stream channels with the implementation of Alternatives 2-5.

Fuels Hand Treatment (WFH)

A total of 5,185 acres of fuels reduction work by hand is proposed in Alternative 2 and 4 with 4,430 acres outside of RHCAs (Table 5). In Alternative 3 approximately 4,658 acres are proposed with 4,047 acres outside of RHCAs and Alternative 5 would treat 4,793 acres with approximately 3,561 acres outside of RHCAs. Fuels reduction work would be conducted by hand only (no mechanical treatment).

Alternatives 2 and 4 propose 753 acres of fuels reduction work by hand in RHCAs, Alternative 3 proposes 612 acres, and Alternative 5 proposes 746 acres (Table 5).

Within and outside of RHCAs WFH units would receive ladder and ground fuels reduction treatment involving precommercial thinning of live trees less than nine inches dbh to a spacing of 14 by 16 feet using chainsaws. Ladder fuels branches on trees up to six feet above ground would be pruned, and slash would be piled by hand and burned. Below are the direct effects of fuels reduction hand treatment inside and outside of RHCAs.

Outside RHCAs

Fuels reduction work by hand would be completed outside of RHCAs which will prevent direct effects to water quality under all action alternatives.

Within RHCAs

Fuels reduction work within RHCAs would be conducted by hand only (no mechanical treatment). For Fuels Reduction work within RHCAs, minimum no activity stream buffers of 10 feet on Class IV streams (intermittent non-fish bearing), 30 feet on Class III streams (perrenial non-fishbearing), and 50 feet on Class I streams (fishbearing) would be implemented. Depending on the amount of slash generated, hand piling and hand burning of slash piles within RHCAs may be required to address fuel accumulations. Small diameter material created from fuels reduction would be hand piled and burned by hand, and would occur outside of no activity stream buffers. Burn piles within RHCAs would be approximately four feet in height and six feet in diameter. All piles would be spaced to avoid damaging or killing overstory trees during burning operations. Piles would be burned when there would be a high soil moisture content and would result in a low intensity burn to minimize effects to soils and vegetation.

No activity stream buffers would prevent direct effects to water quality since minimum no activity stream buffers would be implemented and no treatments occur on streambanks or in the stream channel. There would be no difference in the direct effects to water quality with the implementation of Alternatives 2-5.

Table 5 - Acres of Fuels Hand Treatment Inside and Outside of RHCAs by Alternative

Subwatershed/Treatment Type	Alt 2	Alt 3	Alt 4	Alt 5
Jordan Creek				
WFH	<1	<1	<1	<1
WFH RHCA	0	0	0	0
Lower Anthony Creek				
WFH	496	496	496	496
WFH RHCA	33	33	33	33
Lower North Powder River				
WFH	1	1	1	1
WFH RHCA	0	0	0	0
Middle North Powder River				
WFH	1008	788	1008	809
WFH RHCA	180	153	180	177
Tanner Gulch Grande Ronde				
WFH	53	53	53	53
WFH RHCA	15	15	15	15
Upper Anthony Creek				
WFH	1,490	1,184	1490	1401

Subwatershed/Treatment Type	Alt 2	Alt 3	Alt 4	Alt 5
WFH RHCA	381	280	381	378
Upper Beaver Creek				
WFH	0	0	0	0
WFH RHCA	0	0	0	0
Upper Ladd Creek				
WFH	171	171	171	171
WFH RHCA	16	3	16	16
Upper Wolf Creek				
WFH	1965	1965	1965	1862
WFH RHCA	128	128	128	128
Totals				
Total WFH	**5,184**	**4,658**	**5,184**	**4,793**
Total WFH RHCA	**753**	**612**	**753**	**747**

Prescribed Fire

Prescribed fire intensity is expected to be low in riparian areas, having little effect on riparian conditions. Prescribed fire is not expected to be a source of erosion or sediment delivery. Agee et al. (2002) found that understory vegetation in riparian zones tended to be moister later in the season than in drier upland forests. In low elevation, interior forests such as those with ponderosa pine, Douglas-fir and grand fir, higher understory foliar moisture in riparian zones should dampen surface fire behavoir compared to upland forests late in the dry season. High foliar moisture in understory plants will be associated with lower surface fireline activities as fires approach the riparian zone, even when fire return intervals have been shown to be similar between riparian and upland sites (Olson, 2000).

Prescribed burning would occur when weather and fuel conditions are appropriate to meet the objectives and prescription. Prescribed burning would be accomplished within a 10 year period depending on environmental conditions needed to meet burning prescriptions. There will be no direct ignition within PACFISH RHCAs, but fire would be allowed to back into RHCAs.

Alternative 2 proposes 6,685 acres of prescribed fire, Alternative 3 propose 6,043 acres, Alternative 4 proposes 6,643 and Alternative 5 proposes 6,685 acres (actual burn area). For prescribed fire, no direct ignition within RHCAs would be allowed. This would prevent direct effects to water quality. There would be no difference in the direct effects to water quality with the implementation of Alternatives 2, 3, 4, and 5.

Temporary Roads

Alternative 2 proposes the use of 12.62 miles of temporary road, 6.01 miles are existing wheel tracks and 6.61 miles are new and would be constructed for project use. Alternative 3 does not require new or existing temporary road use. Alternative 4 proposes 2.62, .67 miles on existing temporary roads and 1.95 miles of new construction and Alternative 5 proposes the use of 14.71 miles of temporary road, 6.57 on existing and 8.14 miles of new temporary roads. Table 6 shows temporary roads proposed in each alternative that require culvert installation and removal at stream crossings. Other activities associated with temporary roads, such as construction of new roads and location of roads in relation to streams and riparian habitat would have indirect effects to water quality and are discussed in the indirect effects

section below.

Table 6 - Temporary Road Stream Crossings by Alternative

Temp Roads	Stream Class	Number of Stream Crossings			
		Alternative 2	Alternative 3	Alternative 4	Alternative 5
T-05 (Existing wheel tracks)	Class III	1	0	1	6
	Class IV	1	0	1	2
T-07 (Existing wheel tracks)	Class III	1	0	0	1
T-20 (Existing wheel tracks)	Class III	1	0	0	1
T-22 (Existing wheel tracks)	Class III	1	0	0	1
T-24 (Existing wheel tracks)	Class IV	1	0	0	1
T-26 (Existing wheel tracks)	Class I	1	0	0	1
T-01	Class IV	1	0	1	1
T-21	Class III	2	0	0	2
Summary	Class I	1	0	0	1
	Class III	6	0	1	11
	Class IV	3	0	2	4
Total Crossings		**10**	**0**	**3**	**16**

Class I=fishbearing, Class III=perennial non-fishbearing, Class IV=intermittent non-fishbearing

Because no temporary roads are proposed under Alternative 3 there would be no direct effects to water quality from temporary roads under this alternative. Alternatives 2, 4 and 5 would use a combination of existing wheel tracks and new temporary road construction to facilitate harvest/fuel reduction activities. Any temporary roads used would require culvert installation at stream crossings and culvert removal after completion of project activities. Heavy equipment instream activities associated with the installation and removal of culverts would have short term direct effects to water quality. An increase in sedimentation and turbidity would occur during insream activities. Culvert installation and removal in live streams would take place during the instream work window agreed to in the MOU with Oregon Department of Fish and Wildlife. All culverts would be removed and streambanks would be recontoured after completion of vegetation management treatment, during the same season of use.

Alternatives 2 and 5 both propose construction and use of T-20, T-21 and T-22 to access units 104, 105, and 145. Together these roads would cross Class III perennial streams 4 times and require three culvert installations and removals. The fourth stream crossing on T-22 has an existing log culvert that is partially plugged and collapsing and will need to be replaced to avoid complete failure of the culvert, which would introduce a large amount of sediment into the stream system. These crossings are a tributary to Indian Creek and are less than 0.25 miles from downstream bull trout habitat.

Alternatives 2, 4, and 5 propose use of T-05 to access unit 144 and units 164 and 165 (Alternative 5 only). Alternative 5 would require 8 stream crossings total on temporary road T-05, 6 Class III perennial stream crossings and 2 Class IV ephemeral stream crossings and Alternatives 2 and 4 would require 2

stream crossings, one on a Class III perennial stream and one on a Class IV ephemeral stream. Use of this road would cause direct effects to water quality from the installation and removal of culverts at stream crossings. Because Alternative 5 requires the most miles of road and stream crossings to access units 164 and 165, it would have the largest amount of potential direct effect to water quality through increased sediment input to stream channels from in water work.

Alternative 2 has 10 total stream crossings, all of which would need to have culverts installed with the exception of the Class I crossing on T-26, which has an existing log culvert in place. Alternative 5 has the highest number of stream crossings and therefore the highest number of culvert installations and removals needed. Similar to Alternative 2, the Class I crossing on T-26 would not need culvert replacement, so total culvert installations is 16, with 17 total culvert removals (existing log culvert on T-26 would be removed). Alternative 4 would require three stream crossings, one on a Class III perennial stream and two on Class IV ephemeral streams. In all alternatives culverts would be removed after vegetation management treatment and during the same season of use.

Culvert replacement would have a direct, short term (<48 hours after replacement) effect on water quality. Foltz (2008) studied sediment concentrations and turbidity changes during culvert removals. The study found that 95% of the culvert related sediment occurred in the first 23 hours after culvert removal in streams where flows were low. Where flow locations were higher, 40-95% of the culvert related sediment occurred in the first two hours. Culvert installation and removal in the East Face project would be similar to the low flow sites, since work would be required to happen during low flows and sediment concentrations and turbidity would be expected to return to preconstruction levels within 48 hours after replacement. Jakober (2002) found that after culvert replacement on the Bitterroot National Forest, sediment concentrations decreased to near pre-project levels within 24 hours.

Alternative 5 has the most miles of temporary road that would be required for project access; it also has the highest number of stream crossings that would require culvert installation and removal. Alternative 5 would have the highest amount of short term direct effects to water quality from sediment input caused by the mechanical placement and removal of culverts. Alternative 2 would also have a high amount of short term direct effects to water quality from in water work associated with culvert installation and removal at 13 stream crossings. Alternative 4 would have the least amount of impact from three stream crossings with culvert installation and removal on one Class III stream and two Class IV streams.

Closed Roads for Administrative Use

The miles of closed roads opened for administrative use is 107 miles for Alternative 2, 66.9 miles for Alternative 3, 38.6 miles for Alternative 4 and 122.7 miles for Alternative 5. Under all action alternatives, 6.5 miles of closed road would remain open after project completion. Under Alternatives 2 and 4 approximately 0.6 miles of road currently ML2, open to high clearance vehicles, would be closed after project activities are completed. The only direct effect to water quality from opening closed roads is reconstruction that would involve heavy equipment crossing live streams and culverts that would need to be installed. All other effects including streams crossed (with culverts in place), road miles in RHCA buffers and reconstruction miles in RHCA buffers where culvert installation is not needed are discussed in indirect effects to water quality and stream temperature.

Complete inventory of existing culverts and drainage structures on closed roads proposed to be opened for administrative use does not exist for East Face project area. It is assumed that most closed roads

have culverts at stream crossings in place. In the case that culvert replacements or new installations would be necessary, the direct effects to water quality from in water activities associated with culvert installations and removal is the same as what is discussed above for temporary roads. Culvert installation to open the 7312160 road is discussed in Road Reconstruction below.

Road Reconstruction

Road reconstruction would vary from full reconstruction on some open and closed roads to incidental construction on other open and closed roads depending on the current condition and proposed use.

Maintenance of roads would be required to open closed roads in all project alternatives. The majority of maintenance activities such as brushing, blading and shaping of the road surface, cross drain culvert cleaning, and limited ditch cleaning would not occur instream but would occur on the road prism or immediately adjacent to the road prism and would not result in direct effects to water quality. These road maintenance activities are a potential indirect effect, which is discussed in the indirect effects to water quality section. Culvert installation would be required on certain roads proposed to be opened in some alternatives; this would have direct effects on water quality due to the instream work associated with installation.

Direct effects to water quality would result from the installation of the culvert in the Class III perennial non-fishbearing stream just upstream of the extent bull trout habitat on closed road 7312160 that is proposed to be opened for project access in Alternatives 2 and 5. This is approximately 0.25 miles above the extent of critical habitat for ESA listed bull trout. This culvert was removed during road storage activities and is proposed to be installed for hauling activities associated with fuel reduction activities. In addition open road 7312150 has at least one 18" cross drain removed, has plugged culverts and drainage problems that would potentially require a lot of culvert installation during reconstruction. It is not known how many other closed roads to be opened for project use need culvert replacements or new culverts to be installed due to removal during past road closure activities. Culvert installation would introduce a large amount of sediment into the stream system. Culvert replacements will have a direct, short term (<48 hours after replacement) effect on water quality. Foltz (2008) studied sediment concentrations and turbidity changes during culvert removals. The study found that 95% of the culvert related sediment occurred in the first 23 hours after culvert removal in streams where flows were low. Where flow locations were higher, 40-95% of the culvert related sediment occurred in the first two hours. Culvert replacement in the East Face would be more similar to the low flow sites, and sediment concentrations and turbidity would return to preconstruction levels within 48 hours after replacement. Jakober (2002) found that after culvert replacement in the Bitteroot National Forest, sediment concentrations decreased to near pre-project levels within 24 hours.

In addition, road 7312150 is within an RHCA for 0.61 miles and is adjacent to North Fork Anthony Creek for approximately 2.1 miles. There are three Class III perennial stream crossings on this road that are tributaries to North Fork Anthony Creek. This road requires total reconstruction in close proximity to bull trout habitat.

Use of BMPs such as conducting activities when streamflows are low, development of a Pollution and Erosion Control Plan (PCEP), delineating construction impact areas on project plans and confining work to the noted area, and rehabilition of disturbed areas by mulching and seeding would minimize sediment yield. Vegetation will only be removed if necessary to complete realignment. The culvert would be sized

to prevent the degradation of streambanks and maintain integrity of the stream channel and stream processes. Culvert installatinon and removal would occur during the instream work window specified in Oregon Department of Fish and Game Guidelines for Timing of In-Water Work (2008).

Road Decommissioning

The 31.3 miles of roads identified for decommissioning under all action alternatives are everything from currently open to overgrown and naturally decommissioned. Naturally decommissioned roads would not require actions beyond removing the road sign and removing the road from the transportation system. Road decommissioning activities would take place when road conditions are dry. There are no direct effects to water quality from road decommissioning.

Wolf Creek Culvert Replacement

Replacing the culvert on road 431680 that crosses Wolf Creek is proposed in Alternatives 2-5. This would have an overall beneficial affect and improve fish passage to 5.2 miles of upstream habitat. There would be an increase in sediment and turbidity during and after instream work associated with removing and installing the new culvert. The increase in sediment and turbidity would have short term direct effects to water quality. To mitigate for the effects of construction on water quality, the stream crossing site would be dewatered at time of installation and rewatered after the culvert is installed. See discussion above regarding culvert installation and sediment.

This culvert will be replaced during the instream work window July 1-August 31 specified in Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources (2008) in order to ensure the least potential effect to fish within the system at the time of the activities. There would be no difference in direct effects to water quality in Alternatives 2-5.

North Fork Anthony Creek Bridge Replacement

The 7312 road is the primary haul route for the East Face project area. Due to weight limitations which will not support log haul on the bridge on the 7312 road over the North Fork of Anthony Creek, the old bridge would be physically removed and a new bridge would be installed. Removal of the existing bridge and installation of the new bridge could have direct effects on water quality if any equipment enters the channel or excavator work is necessary to build slopes and abutments. Effects would be the same in Alternatives 2-5.

Indirect Effects to Water Quality

The project activities that would have indirect effects on water quality are opening and hauling on closed roads that have stream crossings or are in RHCAs, reconstructing closed roads that are near live streams and within RHCAs, constructing new temporary roads that are draw bottom or in RHCAs, and handwork within RHCAs.

ALTERNATIVE 1 - NO ACTION

With the non-treatment of stands, fuel conditions in stands, both fuel loadings and accumulation, will be excessive and the likelihood of a high intensity fire occuring is high. Fires have the potential to damage adajcent stands and RHCAs. Interconnected, fuel laden stands may now link areas that historically burned less frequently or uniformily into large, homogemeous areas that are vulnerable to high intensity stand replacing events (Agee 1988; Henjum et al. 1994). Under certain circumstances, such as through fuel accumulations and a hot dry period, riparian zones can act as passages for fire leading to the spread of fire to unburnt uplands (Agee 1998). Under particular conditions, steep sided canyons can act to funnel winds increasing wind speeds that may increase fire rate of spread and operate as a conduit for fire to different parts of the landscape (Dwire and Kaufman 2003). Under some circumstances climatic pre-fire conditions can drive large and intense fires in riparian zones with significant ecological impacts (Pettit and Naiman 2007).

Riparian fires can lead to an increase in sediment yield to stream channels as well as an increase in streambank erosion. The major physical effects of riparian fire are an increase in the likelihood of bank erosion, and the large fluctuations in the delivery of woody debris in the riparian zone and in the stream. Fire increases erosion in the riparian area by removing vegetation, increasing surface runoff, and reducing soil infiltration rates. Fire reduces infiltration rates by creating a hard soil surface crust which is often hydrophobic, and combined with loss of ground cover leads to sheet or gully erosion (Shakesby and Doerr 2006). Fire can destroy accumulated forest floor material and vegetation, altering infiltration by exposing soils to raindrop impact or creating water repellent conditions (DeBano et al. 1998). Loss of soil from hillslopes produces several significant ecosystem impacts. Soil movement into streams may degrade water quality and change the geomorphic and hydrologic characteristics of these systems (Robichaud et al. 2000). Sediment delivery following forest operations and prescribed fire with forested buffers are a magnitude or more lower than following wildfire, and the increased number of disturbances from active forest management result in lower long term average sediment delivery rates than would occur following less frequent wildfire disturbances (Elliot and Robichaud 2001).

Stands and RHCAs proposed for precommercial thinning in the project area are overstocked. In many instances, stress, particularly drought stress, is compounded by overstocking (Fiddler, et al., 1995). This stress can lead to losses in tree growth and increases in insect and disease caused mortality. If left untreated, overstocked stands and RHCAs would stagnate, and tree diameters would remain in smaller size classes (an average of less than eight inches dbh) until a disturbance occurs such as fire, insect infestation or disease. The risk associated with insects and disease is that these could cause an epidemic in adjacent stands and RHCAs resulting in an increased risk of wildfire, increase in sediment yield to perrenial and fishbearing streams in the event of a high intensity fire, and long term loss of wood recruitment and structure to stream channels and hillslopes. Non-treatment of stands and RHCAs could increase sediment yield to stream channels above existing levels under this alternative due to an increase in fire intensity. Appropriate stocking levels can help to increase tree growth and increase resistance of stands to fire, insect, and disease (Lambert, 1994).

High intensity fire within and adjacent to RHCAs has the potential to reduce the long term recruitment of large wood to stream channels. The pulse of snags, logs, and coarse wood generated by a stand replacement fire is the recovering forest ecosystem's sole source of coarse wood until the new stand begins to generate snags and logs of comparable size and heartwood content, which generally takes 150 to 200 years in some forest types (Maser et al. 1988, Franklin et al. 2002, Harmon et al. 2004).

Excessive heat from fires has the potential to cause soil sterility, thereby reducing future regeneration success. Severe site conditions can slow natural regeneration of coniferous trees following a stand replacement burn (Noss et al. 2006).

Non-treatment of RHCAs and stands could result in a long term loss of large wood recruitment to stream channels and hillslopes needed for sediment retention and channel structure, increased loss of RHCAs to wildfire, and could increase sediment yield to stream channels in the event of a high intensity wildfire.

Stream Temperature

With the non-treatment of stands, including RHCA treatments, fuel loadings and accumulation would continue to be excessive and the likelihood of a high intensity fire occuring is high. Fires have the potential to damage adajcent stands and RHCAs. Fires in riparian areas have the potential to elevate stream temperatures. Changes in channel form and reduction in riparian canopy cover due to fire led to elevated stream temperatures for extended periods of up to 10 years in a British Columbia headwater stream (Moore et al. 2005). In smaller streams, riparian fires can defoliate trees, resulting in more light reaching the stream thereby increasing water temperature as well as growth of aquatic and emergent plants (Pettit and Naiman 2007).

ALTERNATIVES 2, 3, 4, and 5

The primary benefits of stand and fuels treatment adjacent to RHCAs and handwork within RHCAs would be ensuring a long term source of large wood recruitment within RHCAs to hillslopes and stream channels for sediment retention, channel structure, riparian function, and reduced risk of a high intensity fire that could lead to sediment yield in fishbearing streams.

Pre-commercial thinning would reduce stocking densities in overstocked stands leaving the healthiest and most vigorous trees that meet species and stocking requirements. This would result in larger trees with fuller crowns in the RHCA for recruitment to stream channels and hillslopes for sediment retention, channel structure, and stream shade. In addition, there would be a decreased risk of insect and disease infestation in adjacent stands, including overstocked conditions and ladder fuels in RHCAs, which, if left untreated, could contribute to higher fire intensities than those that would have occurred historically leading to a long term (>100 years) reduction of large wood recruitment and potential increase in sediment yield to streams.

The most documented effect of precommercial thinning is increased diameter growth caused by the redistribution of the environmental resources among a smaller number of selected trees. When the number of stems per hectare is very large, the leaf area of each tree could be so limited that few carbohydrates are available for height development and stagnation of growth occurs (Pothier 2002).

The primary benefits of stand and fuels treatment on stream temperature is reducing the risk of high intensity fire to adjacent RHCAs. Treatment of stands and fuels reduction will reduce the risk of the loss of streamshade, which could lead to elevated stream temperatures. Pre-commercial thinning would result in larger trees with fuller crowns in the RHCA for stream shade. In addition, there would be a decreased risk of insect and disease infestation in adjacent stands and RHCAs, which could contribute to higher fire intensities.

Typical riparian conditions such as wide spacing and mixed conifer or hardwood stands allow later crown closure than tightly packed plantations (Berg 1995). Homyack et al. (2004) found that stands thinned six to 11 years prior to the study had a greater overstory structure than similar untreated stands. In contrast, unthinned stands gained little overstory structure indicating that the application of pre-commercial thinning was responsible for the accelerated height and diameter growth.

Summary of Benefits – More of the benefits described above would be realized under Alternatives 5, 2 and 4 than Alternative 3 related to stand management outside of riparian areas. Alternatives 2 and 4 would treat the most riparian acres (992 acres) followed by Alternative 3 (837 acres) and Alternative 5 (791 acres); therefore, generating the most benefits to riparian vegetation health, vigor, and sustainability over time.

Commercial Removal

Commercial removal includes (HFU, HIM, HPO, HPO, HPR, HSA, HSH, HTH, WFH-BIO, and PCT-BIO) units. Table 2 describes the number of acres to be commercially harvest and the acres of each logging system to be used to facilitate log removal. Generally, skyline yarding is used on ground with slopes >35% for removal of material, and ground based equipment is used on ground with slopes <35%. Table 6 shows the total number of acres of commercial removal by subwatershed.

Table 7 - Acres of commercial treatment by subwatershed

Subwatershed	Alternative 2 Acres	Alternative 3 Acres	Alternative 4 Acres	Alternative 5 Acres
Lower North Powder	44	0	44	60
Middle North Powder	1,095	479	1,016	1,095
Upper Anthony Creek	1,247	939	738	1,248
Lower Anthony Creek	1,052	455	272	1,741
Upper Wolf Creek	1,815	951	656	2,029
Upper Ladd Creek	175	142	95	175
Upper Beaver Creek	1,290	911	18	1,311
Tanner Gulch-Grande Ronde	0	0.5	0	0.5
TOTAL Acres	**6,719**	**3,877**	**2,839**	**7,659**

Best management practices and RHCA buffer widths would be used as no activity stream buffers for commercial removal activities which would prevent indirect effects to water quality and stream temperature. Rashin et al. (2006) demonstrated the effectiveness of best management practices for controlling sediment related water quality impacts from timber harvest activities. Rashin et al. found that stream buffers were most effective where timber falling and yarding activities were kept at least 10 meters (approximately 33 feet) from streams and outside of steep inner gorges. This 10 meter buffer for ground disturbing activities was found to prevent sediment delivery to streams from about 95% of harvest related erosion features. Of 193 erosion features located 10 meters from the stream channel, 95% did not deliver sediment. Rashin et al. found that virtually all chronic sediment delivery was associated with skid and shovel trails that crossed streams. There would be no stream crossings with equipment of any perennial fishbearing streams within the project area.

Lakel et al (2010) studied four streamside buffer widths or streamside management zones (SMZs) for the effectiveness of sediment retention after forest harvest and site preparation. The study was conducted in

the Piedmont physiographic region of Virginia. Piedmont soils are highly susceptible to erosion. All SMZs had intact litter layers and were similarly effective for trapping sediment. Side slopes within the study watersheds averaged 25% and ranged from 10% to 65%. The four SMZs studied were:

- 7.6 meters (24.9 feet) with no thinning in the SMZ,
- 15.2 meters (49.9 feet) with no thinning in the SMZ,
- 15.2 meters (49.9 feet) with thinning within the SMZ with 30% to 50% basal area removed,
- 30.4 meters (99.7 feet) with no thinning in the SMZ.

Treatments included clearcut harvest; dozer created firelines between harvest, and SMZs, and prescribed fire. Results indicate that 97% of eroded materials were trapped within the harvest area or the SMZ before reaching the stream, and that pre-harvest and post-harvest sediment data was not significantly different for the four SMZ treatments. Three of the study watersheds had sediment bypass the SMZ regardless of SMZ width and the apparent causes were failed water control structures associated with road segments or firelines on steep, fragile soils that concentrated flow creating scouring and minor channel formation. In contrast, there would be no dozer created fire lines within the project area during harvest activities, commercial fuel reduction activities are proposed only outside of the RHCA stream buffers.

The stream buffers widths are also based on the riparian microclimate in the Blue Mountains of Oregon. Microclimate is an important element of ecosystem management as it influences biological processes such as primary production and decomposition, and the physical environment determining habitat suitability for many organisms (Chan et al. 2004).

Danehy and Kirpes (2000) found that the riparian microclimate gradient on four perennial streams in the Grande Ronde Basin of eastern Oregon extended no more than10 meters (30 feet) from the edge of the stream channel into the upland forest. Beyond 10 meters humidity was similar to upland conditions. Indian Creek, a perennial stream in the Upper Grande Ronde River, was one of the study streams and has similar habitat conditions to many of the streams within the East Face area. The minimum RHCA stream buffers would protect the riparian microclimate, which includes stream temperature.

A study conducted by Chan et al. (2004) on four different buffer widths with upland density management (thinning) suggest that riparian buffers of various configuration results in relatively small changes in the riparian climate. Buffer widths in the study were 1) streamside retention (less than 25 feet), 2) variable width (about 57 feet), 3) one site potential tree width (about 201 feet), and 4) two site potential tree widths (about 400 feet). The study involved small headwater streams, and results of the study found that the area between the stream and 15 feet lateral distance from the stream is uniquely riparian with respect to microclimate. This 15 foot zone is remarkably resistant to microclimate changes from upland thinning treatments.

A study conducted by Wilkerson et al. (2006) in headwater streams in Maine found that 11 meter (36 feet) buffer widths with clearcuts on either side and partial harvest within the buffer had moderate, but statistically insignificant increases in stream temperature while 23 meter (76 feet) buffer widths with clearcuts on either side and partial harvest in the buffer had no observable increases in temperature. Both treatments retained >60% of the canopy. Moore et al. (2005) found that temperature increases in headwater streams are unlikely to produce substantial changes in the temperature of larger streams into which they flow, unless the total inflow of clear-cut heated tributaries constitutes a significant proportion of

the total flow in the receiving stream. No clearcut or regeneration harvests are proposed along perennial streams and no harvest is proposed within no activity buffers. All shade producing vegetation will be retained within no treatment buffer, and a fully stocked stand will remain beyond the buffers to provide stream shade.

Based on the above studies, no activity stream buffers would prevent or minimize sediment yield resulting in a non-measurable amount of sediment reaching the stream, and would not result in an increase in stream temperature.

Precommercial Thinning (PCT)

Precommercial thinning acres proposed for treatment under Alternatives 2-5 are described in Table 1. The majority of proposed precommercial thinning acres would occur outside of RHCA buffers, however some acres of RHCA thinning is proposed in each alternative to improve conditions of riparian stands. See Table 4 for acres of PCT treatment inside and outside of RHCA buffers by subwatershed.

Below are the indirect effects of precommercial thinning outside and inside of RHCAs.

PCT- Outside of RHCAs

Alternatives 2, 3, 4 and 5 propose acres of precommercial thinning (PCT units) outside of RHCAs. Precommercial thinning outside of RHCAs includes handwork on slopes >30% and the use of handwork or slashbusters (mastication) on slopes <30%. Mechanical thinning activities would be outside of RHCAs, which would prevent indirect effects to water quality in a manner similar to that described under commercial harvest above.

PCT- Within RHCAs

All Alternatives propose acres of precommercial thinning (PCT units) in old harvest units within RHCAs. Thinning of overstocked trees <9 inches dbh, and hand piling and burning of slash would occur in old harvest units within RHCAs. Trees would be thinned to a 14 by 16 foot variable spacing. Stream buffers for WFH PCT are based on the riparian microclimate. For precommercial thinning by hand within RHCAs, minimum no activity stream buffers of 10 feet on Class IV streams (intermittent non-fish bearing), 30 feet on Class III streams (perennial non-fishbearing, and 50 feet on Class I streams (fishbearing) would be implemented. Depending on the amount of slash generated, hand piling and hand burning of slash piles within RHCAs outside of minimum no activity stream buffers may be required to address fuel accumulations. PCT units with RHCA hand treatment include units 304, 305, 308, 309, 314, 318, 319, 320, 326, 327, 332, 333, 368, 376, 382, 387, 399, 410, 418, 420, 422.

Work within RHCAs would be conducted by hand, which would result in minimal ground disturbance. A study conducted by Madrid et al. (2006) evaluated three silvicultural treatments, which are 1) untreated control, 2) precommercial thin with slash piled, and 3) precommercial thin with slash scattered. Treatments were done by hand. Fuels reduction and thinning within RHCAs in the East Face project are similar to the treatment described in number two above, precommercial thin with slash piled. Ground disturbance in the pile treatment ranged from no ground disturbance to slight roughing of the litter with slight exposure of mineral soil where slash was hauled to piles. Sediment yield was statistically different and greater on pile and scatter treatments than the untreated control or thin and pile treatments during wet runs (precipitation). Median sediment yield for the untreated control was 0.36 kg ha-1, thin and pile

treatment was 0.83 kg ha-1, and the thin with slash scattered was 0.90 kg ha-1. Sediment yield for both treatments was still very low and within erosion rates of undisturbed forested watersheds. Studies have reported that undisturbed forested watersheds have erosion rates from near 0 to 560 kg ha-1 (Binkley and Brown, 1993). Median values modeled for both dry and simulated storm events were below 2 kg ha-1. The values for thin and pile are very close to zero and well within background levels for erosion rates of undisturbed forested watersheds. Amount of sediment generated by this activity is not measurable since the values described above are very close to zero and are the background levels of natural sediment yield in undisturbed forested watersheds. The study concluded that infiltration rates, runoff rates, and soil moisture content did not differ among treatments.

Best Management Practices monitoring on the La Grande Ranger District supports these research findings. Mechanical treatment in RHCAs in the Starkey and Horsefly Vegetation Management Projects found that there was no offsite movement of sediment, no sediment movement through the no-treatment stream buffers of 50 feet on perennial and 30 feet on intermittent streams, and no sediment yield to stream channels. This was mechanical treatment. Hand treatment results in minimal to no ground disturbance, does not compact soils, and would result in very small amounts of sediment that would not be measurable above background levels. With handwork there are no skid or shovel trails that cross streams or any other mechanical ground disturbance. The stream buffers described for hand treatment allow optimum hand treatment of the RHCA with no risk of adverse effects to listed fish or designated critical habitat.

Fire intensity in thinned stands is greatly reduced if thinning is accompanied by reducing the surface fuels created by the cuttings (Graham et al. 1999). A study conducted by Kalabokidis and Omi (1998) found that thinning combined with slash treatment is an effective means for reducing fire spread, reducing the resistance to control, and reducing ecological losses. Thinning with no slash modification is an inappropriate option because more fuel becomes available for combustion contributing to extreme fire outcomes such as crowning and erratic fire behavior. Slash fuels increase the fire hazard as long as they remain on the ground, so prompt treatment with prescribed fire or mechanical means is important (Fule et al. 2001).

Hand piling and hand burning of small piles are not a source of erosion, do not create overland flow, and therefore are not a source of sediment to stream channels. Seymour and Tecle (2004) conducted a study of the effects of burning hand piled slash on physical soil characteristics of soil bulk density, soil porosity, infiltration capacity, and soil moisture content. The size of hand piles studied were small, round hand piles 1.2 meters high (3.9 feet) and 2.4 meters in diameter (7.9 feet); and large hand piles 2 meters high (6.6 feet), 4 meters wide (13 feet), and 5 meters long (16 feet). Unburned large and small hand piles and control treatments were used to measure differences in physical soil characteristics between treatments. Study results indicate that there were no significant differences in soil bulk density and porosity, soil infiltration capacity, or soil moisture between treatments. Since bulk soil density and porosity were not significantly affected, soil infiltration rates were not reduced indicating the absence of the formation of a hydrophobic layer that could lead to overland flow and erosion.

Precommercial thinning slash hand piles within RHCAs would be similar in size to the “small” hand piles described in the study above, and average size of piles would be approximately four to five feet high and eight feet in diameter. Piles would be burned when there would be a high soil moisture content and would result in a low intensity burn to minimize effects to soils and vegetation. An inspection of small diameter burn piles, similar to those described above, in the South Fork Catherine WUI Project area

within the RHCA of a perennial stream found good soil moisture and infiltration in the footprint of burn piles and virtually no erosion or offsite movement of sediment. It was determined that the small burn piles retained roughness and soil infiltration, and also lacked the surface area and hydrophobic soils needed to create overland flow. This verifies the results of the research described above.

Sediment yield from precommercial thinning and hand piling and burning of slash would be very close to zero due to minimal ground disturbance, and well within the background levels of sediment yield in undisturbed forested watersheds. Given that small burn piles are not a source of sediment, that there will be minimal ground disturbance in the RHCA, and that minimum no activity stream buffers will retain the small amount of sediment, there will be a negligible effect to water quality.

There would be no difference in the indirect effects to water quality with the implementation of Alternatives 2, 3, 4 or 5 since no activity stream buffers would be implemented and adequately protect water quality as described above. PCT activities and effects within RHCAs are very similar to WFH activities and effects in RHCAs.

Stream Temperature

A minimum 50 foot no activity stream buffer on fishbearing streams and minimum 30 foot buffer would prevent removal of shade producing vegetation and alteration of stream temperatures. Only small diameter understory trees, <9 inches dbh would be thinned and all overstory trees would remain. Intermittent non-fishbearing streams within the project area are typically dry by mid-June and do not contribute to summer stream temperatures and are therefore not an issue for maximum stream temperatures. No overstory trees would be removed from within RHCAs that could increase stream temperatures.

The 50 foot and 30 foot minimum no activity stream buffers are based on the riparian microclimate. Microclimate studies are discussed under the indirect effects of Commercial Removal section above.

Fuels reduction handwork within RHCAs would not increase stream temperatures due to the minimum 50 foot no activity buffer on fishbearing streams, minimum 30 foot no activity stream buffer for perennial no-fishbearing streams, thinning prescriptions, and no overstory removal in RHCAs. Understory thinning would occur, and the overstory canopy would remain intact to provide stream shade.

There would be no difference in the indirect effects to water quality with the implementation of any of the action alternatives.

Fire Fuels Treatment (FFU)

A total of 90 acres of fire fuels treatment is proposed in Alternative 4 only. See Table 3 for total acres of FFU treatment by subwatershed. All of these acres are outside of RHCAs.

Fuels reduction outside of RHCAs includes mechanical treatment using a slash buster (mastication) and piling slash with a grapple pile machine. For FFU units RHCA buffer widths would be implemented as minimum no activity stream buffers and would prevent indirect effects to water quality from fuels reduction activities outside of RHCAs.

Fuels Hand Treatment (WFH)

As described in Table 1 a total of 5,184 acres of fuels reduction work by hand is proposed in Alternative 2 and 4 with 4,430 acres of that outside of the RHCAs. In Alternative 3 approximately 4,658 acres are proposed with 4,047 acres outside of the RHCA and in Alternative 5 would treat 4,793 acres with approximately 3,561 acres outside of RHCAs. Fuels reduction work would be conducted by hand only (no mechanical treatment).

Alternatives 2 and 4 propose 754 acres of fuels reduction work by hand in RHCAs, Alternative 3 proposes 612 acres, and Alternative 5 proposes 746 acres.

Units would receive ladder and ground fuels reduction treatment involving precommercial thinning of live trees less than nine inches dbh to a spacing of 14 by 16 feet using chainsaws. Ladder fuels branches on trees up to six feet above ground would be pruned, and slash would be piled by hand and burned.

Outside RHCAs

Due to the implementation of no activity RHCA buffers, there would be no indirect effects to water quality under all action alternatives from hand fuels treatments.

Within RHCAs

Fuels reduction work within RHCAs would be conducted by hand only (no mechanical treatment). RHCA areas would receive the same fuels reduction treatments as those outside of the RHCAs. Alternatives 2 and 4 propose 754 acres of fuels reduction work by hand in RHCA's, Alternative 3 proposes 612 acres, and Alternative 5 proposes 746 acres. Minimum RHCA buffers would be the same as those described for precommercial thinning RHCA treatments. Hand piling and hand burning of slash piles within RHCAs may be required to address fuel accumulations. Small diameter material created from fuels reduction would be hand piled and burned by hand, and would occur outside of no activity stream buffers. Burn piles within RHCAs would be approximately four feet in height and six feet in diameter, spaced to avoid damaging or killing overstory trees, and would be burned when there is a high soil moisture content resulting in a low intensity burn to minimize effects to soils and vegetation.

Because no activity stream buffers would prevent indirect effects to water quality (sediment and stream temperature) there would be no difference in the indirect effects to water quality with the implementation of Alternatives 2-5 from those described under precommercial thinning within RHCAs above. Fuels reduction units with hand treatment include units 301, 302, 306, 307, 310-312, 316, 328, 335, 336, 353, 355, 357, 359, 366, 369, 377, 383, 392, 393, 395, 397, 401, 404, 406-409, and 414.

Prescribed Fire

Alternative 2 and 5 propose 6,685 acres of prescribed fire, Alternative 3 proposes 6,043 acres and Alternative 4 proposes 6,643 (actual burn area). Prescribed burning would occur when weather and fuel conditions are appropriate to meet the objectives and prescription. Prescribed burning would be accomplished within a 10 year period depending on environmental conditions needed to meet burning prescriptions. There will be no direct ignition within RHCA buffers, but fire would be allowed to back into RHCAs.

The use of prescribed fire would not increase sediment delivery rates to stream channels over and above the natural sediment rates of the subwatershed. There would be no direct ignition within PACFISH RHCAs, but fire would be allowed to back into RHCAs. The fire intensity is expected to be low in riparian areas, having little effect on riparian conditions. Prescribed fire is not expected to be a source of erosion or sediment delivery.

Agee et al. (2002) found that understory vegetation in riparian zones tended to be moister later in the season than in drier upland forests. In low elevation, interior forests such as those with ponderosa pine, Douglas fir and grand fir, higher understory foliar moisture in riparian zones should dampen surface fire behavoir compared to upland forests late in the dry season. High foliar moisture in understory plants will be associated with lower surface fireline activities as fires approach the riparian zone, even when fire return intervals have been shown to be similar between riparian and upland sites (Olson, 2000).

Control lines would include roads, natural barriers (rock outcrops, rock bluffs, rocky scabs etc.), and brush removal rather than bare mineral soil line construction where possible.

There would be no difference in the effects to water quality between Alternatives 2 and 5 as a result of prescribed fire since the same acres are proposed for both alternatives. Alternative 4 has slightly fewer acres of prescribed fire and Alternative 3 has about 600 acres fewer. No indirect effects are expected in an alternative since RHCA buffers will be implemented and only a minimal amount of RHCA may burn in the event that prescribed fire backs into an RHCA.

Stream Temperature

Prescribed burning would occur when weather and fuel conditions are appropriate to meet the objectives and prescription. Prescribed burning would be accomplished within a 10 year period depending on environmental conditions needed to meet burning prescriptions. There would be no direct ignition within RHCA buffers, but fire would be allowed to back into RHCAs. See Table 7 for total acres of prescribed fire by subwatershed.

The use of prescribed fire would not increase stream temperatures because of the no direct ignition within RHCA requirements allowing fire to only back into RHCAs. The fire intensity is expected to be low in riparian areas, having little effect on riparian vegetation or the conifer overstory.

There would be no difference in the effects to stream temperature between Alternative 2 and Alternative 5 as a result of prescribed fire since the same acres are proposed for both alternatives. Alternative 4 has slightly less acres of prescribed fire and Alternative 3 has about 600 acres less. No indirect effects to stream temperature are expected in any alternative since RHCA buffers would be implemented and only a minimal amount of RHCA may burn in the event that prescribed fire backs into an RHCA.

Temporary Roads

Alternative 2 proposes the use of 12.62 miles of temporary road, 6.01 miles are existing wheel tracks and 6.61 miles would be new construction for project use. Alternative 3 does not require temporary road construction. Alternative 4 proposes 2.62, .67 miles on existing wheel tracks and 1.95 miles of new construction and Alternative 5 proposes the use of 14.71 miles of temporary road, 6.57 on existing wheel tracks and 8.14 miles of new temporary roads. Table 8 shows the miles of temporary road in RHCA by alternative. The number of stream crossings where culverts would be installed and removed is located in

Table 5. Building new temporary roads is expected to have more indirect effects to water quality due to vegetation and soil disturbance associated with clearing vegetation and roadbed construction compared to use of existing wheel tracks, which would require less construction.

Table 8 - Miles of Temporary Road in RHCAs by Alternative

Temp Roads	Miles of Road in RHCA			
	Alternative 2	Alternative 3	Alternative 4	Alternative 5
T-05 (existing wheel tracks)	.13	0	.13	.5
T-06 (existing wheel tracks)	.03	0	0	.03
T-07 (existing wheel tracks)	.21	0	0	.21
T-20 (existing wheel tracks)	.07	0	0	.07
T-22 (existing wheel tracks)	.12	0	0	.12
T-24 (existing wheel tracks)	.64	0	0	.64
T-25 (existing wheel tracks)	.25	0	0	.25
T-26 (existing wheel tracks)	.20	0	0	.20
T-1	.04	0	.04	.04
T-10		0	0	
T-17	.08		0	.08
T-20 (new)	.04	0	0	.04
T-21	.17	0	0	.17
T-35	.05		0	.05
T-39		0	0	.07
Total Miles New	**.38**	**0**	**.04**	**.44**
Total Miles Existing Wheel tracks	**1.64**	**0**	**.13**	**2.02**
Total Miles	**2.01**	**0**	**.17**	**2.46**

Alternative 3 does not propose use of temporary roads and would therefore have no indirect effects on water quality or stream temperature from temporary roads.

Alternative 2, 4, and 5 each have temporary roads within RHCA buffers; the majority of them are existing wheel tracks with the remainder being primarily less than 400 feet in length. Most temporary roads in Alternatives 2, 4 and 5 are located in uplands outside of RHCAs; however, Table 8 displays the miles that are located in RHCA buffers or draw bottom roads and would have indirect effects on water quality and stream temperature. Installation and removal of culverts was discussed in direct effects to water quality.

Alternatives 2 and 5 would have the most indirect effects to water quality from crossing Class I fish bearing stream, and Class III perennial streams and from miles of road that will be used for hauling in the RHCA buffers. The new and existing wheel track temporary roads that have highest risk to water quality that are proposed to be constructed and used in Alternatives 2 and 5 are T-24, T-25, T-26, T-22, and T-07. The T-24 road is in the valley bottom and is in very close proximity to to Class I bull trout stream for approximately 0.5 miles. The road is within 15-20 feet of Class I habitat until it splits with the T-25 and the T-25 is immediately adjacent to Class I habitat for another 0.25 miles. Temporary road T-26 crosses East Fork of Indian Creek, Class I habitat, and is in the buffer of Class I crossing for 0.2 miles. Due to the proximity of this road to fish bearing habitat and Class III habitat immediately upstream of Class I habitat, opening this road and using it for hauling would cause a continued source of sediment to fishbearing Indian Creek and the east fork of Indian Creek. Temporary roads T-20, T-21 and T-22 together cross Class III perennial streams four times. The only crossing structure on this road is an old log culvert at the crossing as the road enters unit 104 and it plugged and collapsing and is causing water to run down the road. This structure will need to be replaced. Temporary road T-07 (proposed for use in Alternatives 2 and 5) is in a draw bottom for its 0.21 length. The road is immediately adjacent to Class III habitat. Due to the location this would contribute sediment to the adjacent stream during project operations in Unit 61.

Alternative 4 proposes 2.67 miles of temporary road use, but all roads are in the upland and outside of RHCA buffers except for 0.17 miles. The two roads that have some length within RHCA buffers are not the high risk temporary roads discussed above, however there are two stream crossings on road T-05, one Class III and one Class IV and one crossing on temporary road T-1 at a Class IV crossing. Some additional sediment would be expected at these locations from project road use and log haul operations; however, neither of these are drawbottom roads and the extent of road in the RHCA buffer is at the stream crossing.

Alternatives 2 and 5 pose the most risk to water quality due to the over 2 miles of temporary road in RHCA buffers and adjacent to streams and the use of roads T-24, T-25, T-26, T-22 and T-07 as discussed above. Alternatives 2 and 5 would potentially have more indirect effect to water quality due to the locations of these roads and the 13 and 20 stream crossings that would receive additional sediment associated with erosion from opening roads, road maintenance, and hauling operations. It is important to note with these roads of concern that the road beds already exist as wheel tracks on the ground and some roads that are not vegetated in or blocked with berms may currently receive unmanaged motor vehicle use. In Alternatives 2 and 5 these roads would be properly obliterated after completion of the harvest activities, eliminating potential for future motor vehicle use and impacts in these areas. Under Alternatives 3 and 4, they would remain in present condition and could receive unmanaged vehicle use.

All temporary roads would be built, used, and restored during the dry season and during the same season of use. After use, temporary roads will be subsoiled where appropriate, returned to original contours where needed and wood debris scattered across the footprint of the temporary road where debris is available. All stream crossing structures would be removed from the road prism and drainage across the road prism would be addressed to restore stream network connectivity.

Closed Roads Opened For Administrative Use

The miles of closed roads proposed to be opened for administrative use is 107 miles for Alternative 2, 66.9 miles for Alternative 3, 38.6 miles for Alternative 4 and 122.7 miles for Alternative 5. Under all action alternatives, 6.5 miles of closed road would remain open after project completion. Under Alternatives 2

and 4, 0.6 miles of road currently ML2, open to high clearance vehicles, would be closed after project activities are completed.

All action alternatives propose to open closed roads which cross streams, including fishbearing streams, and are within RHCA buffers. In Alternatives 2 and 5, the closed roads that would be opened have 7 Class I fishbearing stream crossings, 30 closed roads with 56 perennial non-fishbearing stream crossings (Class III), and 19 closed roads crossing 26 intermittent non-fishbearing streams (Class IV). Alternatives 3 and 4 each have one road that crosses one Class I fish bearing stream. Alternative 3 has 14 closed roads with 23 Class III perennial stream crossings and 12 closed roads with 18 Class IV intermittent stream crossings. Alternative 4 has 10 roads with 15 Class III perennial stream crossings and 7 roads with 9 intermittent Class IV stream crossings. Alternative 5 has 5 roads with 7 Class I fishbearing stream crossings, 28 roads with 52 Class III perennial stream crossings and 13 roads 20 Class IV intermittent stream crossings. Table 10 shows the closed roads to be opened and stream classes crossed, and Table 11 shows approximate total distance of RHCA buffers that these closed roads traverse. In addition, all alternatives had miles of open and closed road that need full reconstruction that are in RHCAs, depending on the reconstruction needed and ground disturbance necessary to reconstruct the road, there is potential for indirect effects on water quality. Alternatives 2 and 5 have the most miles of road to be reconstructed within RHCA buffers (see Table 9) and would likely have highest potential for indirect effects to water quality from sediment input to streams.

Closed roads used for the project will be reclosed after use and would consist of closing and locking of gates where present, or replacing earthen barricades. There are miles of closed draw bottom roads would be opened for project purposes in all Alternatives including 4315930 and 4300330. These roads are proposed to be used in Alternatives 2 and 3, 4315930 is also proposed to be used in Alternative 4 and 4300330 is proposed to be used in Alternative 5. Using alternative routes is preferable to opening and using drawbottom roads for access and hauling. Roads 43, 4330, 4350, and 4380 are all roads used in all action alternatives and are proposed to remain open to vehicular traffic. All have some serious drainage and erosion concerns and have miles within RHCA buffers.

Road Reconstruction

Table 9 - Miles of Reconstruction

Road Work	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Roads with full reconstruction	**52.9**	**39.3**	**27.8**	**61.6**
Open Roads	20.4	20.9	16.5	23.6
Closed Roads	32.5	18.4	11.3	38
Roads with incidental reconstruction	**35.5**	**18.2**	**16.5**	**42.2**
Open Roads	.1	.1	.1	.1
Closed roads	35.4	18.1	16.4	42.1
Total	**88.4**	**57.5**	**44.3**	**103.8**
Total miles of road reconstruction in RHCA buffer	43.6	30.9	18.8	49.26

Maintenance of closed roads may be required. Maintenance includes brushing, spot rocking, blading and shaping of the road surface, cross drain culvert cleaning, and limited ditch cleaning. A culvert on road 7312160 on a perennial Class III non-fish bearing stream was removed and would need to be installed in Alternatives 2 and 5 since both of those alternatives propose using that road. This culvert installation is less than .25 miles upstream of the extent of bull trout habitat. It is unknown how many other culverts on closed roads will need to be replaced or installed to open closed roads for project access and use. Any culvert installation will have direct effects on water quality.

The majority of maintenance activities such as brushing, blading and shaping of the road surface, cross drain culvert cleaning, and limited ditch cleaning would not occur instream but would occur on the road prism or immediately adjacent to the road prism.

Road maintenance can reduce sediment delivery to stream channels through improved drainage and reduced erosion of the road surface by directing water off of the road surface. Road maintenance is necessary to keep roads in good condition, minimize erosion, and identify and correct problems promptly (Furniss et al. 1991). Maintenance keeps roads in a condition suitable for travel and prevents severe erosion from failure of the drainage system (Luce and Black 2001).

Blading consists of pulling material from the sides of the road inwards to redevelop the road crown. All material would remain on the road surface. Luce and Black (2001) observed that blading of only the traveled roadway on an aggregate surfaced road with well vegetated ditches yielded no increase in sediment production from a complete road segment, while blading of the ditch, cutslope, and traveled roadway substantially increased sediment yield from road segments. Results from a study conducted by Luce and Black (2001) suggest that blading the ditch has a greater effect than traffic on sediment yield, and that ditch grading can increase sediment yields on a level comparable to or greater than wet weather hauling. Cleaning ditches and removing the cutslope vegetation caused a dramatic increase in sediment production. Sediment yields from older roads with undisturbed ditchlines are much smaller than sediment yields from newer roads or roads with disturbed ditchlines. Disturbance of the road surface alone through grading showed less effect. No cutslope grading or removal of vegetation from cutslopes is proposed for closed roads that would be opened for administrative purposes. No widespread ditch cleaning is proposed for closed roads. Some small scale, local, and scattered ditch cleaning may be needed. The majority of vegetated ditchlines would remain to trap sediment before reaching streams.

Brushing out of the road prism would not cause ground disturbance. Vegetation is trimmed back approximately six feet either side of the traveled roadway. Removal of some vegetation (brushing) may be needed where the closed roads cross through RHCAs. Vegetation would only be removed where it has grown over or into the road prism making travel difficult. No streamside vegetation would be removed. Only that vegetation within the road prism would be removed and would have no effect on stream temperature. Intermittent non-fishbearing streams within the project area are typically dry by mid June and do not contribute to summer stream temperatures and are therefore not an issue for maximum stream temperatures.

Spot rocking will prevent rutting, erosion and puddling of the road surface. Swift (1984) investigated the influence of graveled, ungraveled, and grassed road surfaces on soil erosion. The study concluded that the graveled road surface with vegetated sideslopes have the lowest soil loss compared to ungraveled and grass road surfaces.

Replacement of the culverts on closed roads as part of reconstruction for project use is discussed in direct effects to water quality above.

Implementation of Best Management Practices would minimize indirect effects to water quality as a result of culvert replacement. Best Management Practices include:

- delineating construction impact areas on project plans and confining work to the noted area,
- conducting during dry conditions,
- minimizing vegetation removal and ground disturbance,
- establishing designated areas for equipment staging and stockpiling of materials,
- mulching and seeding disturbed soils with native grasses.

A pollution control plan (PCP) would be used to protect water quality or respond to toxic spills that could threaten water quality.

Culvert replacement would not have an effect on stream temperature. Only that vegetation associated with the roadbed and culvert would be removed. No overtsory vegetation would be removed. In addition, this is a very small corridor compared to the length of stream, and vegetation removed would not increase solar exposure to the point where stream temperatures would increase.

Roads will be used only under dry or frozen conditions to minimize sedimentation to stream channels. Prohibition of wet weather haul is an increasingly common best management practice that is effective in reducing sediment production from existing roads (Luce and Black 2001). Some types of impacts can be avoided simply by keeping people off roads during part of the year. This approach has been taken to decrease road surface erosion rates during wet weather (Ried et al. 1994).

The degree of sedimentation to stream channels above existing levels is expected to be low since roads would be used only under dry and frozen conditions and established vegetation on the road margins, sides of the road prism, and in ditches would be retained to filter and trap sediment.

Alternatives 2 and 5 would have the greatest potential for indirect effects to water quality because of the total miles of closed road open, miles of closed road open within RHCA buffers and the 89 and 79 stream crossings including 7 Class I fish bearing stream crossings and at least one known perennial Class III culvert installation on the 7312160 road. Alternative 2 has 19.2 miles of road that will be opened for project use that is within RHCA buffers and Alternative 5 has 17.29 miles within RHCA buffers. In addition Alternatives 2 and 5 have the highest amount of closed and open road miles to reconstruct within RHCA buffers 43.6 in Alternative 2 and 49.26 in Alternative 5. Alternative 4 would have the least amount of indirect effects to water quality with 38.6 miles of closed road, 25 stream crossings including one Class I fish bearing stream and 4.94 miles in RHCA buffers compared to Alternatives 2, 3, and 5. Alternative 3 would have greater potential for indirect effects to water quality than Alternative 4, but less than Alternatives 2 and 5 with 66.9 miles of closed road to open, 9.53 miles in RHCA buffers and 42 stream crossings including one Class I fish bearing stream crossing. In addition, road reconstruction and use, such as log hauling over 107 and 122 miles of road has potential to increase sediment input at stream crossings.

Table 10 - Closed road to be opened and stream classes crossed by Alternative.

Road Number	Number Stream Classes Crossed											
	Class I				Class III				Class IV			
	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 2	Alt. 3	Alt. 4	Alt. 5
4300075	0	0	N/A	N/A	0	0	N/A	N/A	1	1	N/A	N/A
4300140	0	0	N/A	0	2	2	N/A	2	3	3	N/A	3
4300235	0	0	N/A	0	1	1	N/A	1	0	0	N/A	0
4300350	1	1	N/A	1	0	0	N/A	0	0	0	N/A	0
4300370	0	0	N/A	0	2	2	N/A	1	0	0	N/A	0
4300420	0	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	1
4300450	0	N/A	N/A	0	0	N/A	N/A	0	2	N/A	N/A	2
4300515	0	0	N/A	0	0	0	N/A	0	1	1	N/A	1
4300720	0	N/A	0	0	1	0	1	1	0	N/A	0	0
4315710	0	0	N/A	0	1	1	N/A	1	0	0	N/A	0
4315800	0	0	0	N/A	0	0	0	N/A	1	1	1	N/A
4315900	0	0	0	N/A	0	0	0	N/A	1	1	1	N/A
4315930	0	0	0	N/A	0	0	0	N/A	1	1	1	N/A
4315940	0	0	0	N/A	0	0	0	N/A	1	1	1	N/A

Road Number	Number Stream Classes Crossed											
	Class I				Class III				Class IV			
	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 2	Alt. 3	Alt. 4	Alt. 5
4316085	0	N/A	0	0	0	N/A	0	0	1	N/A	1	1
4316100	0	0	0	0	1	1	1	1	0	0	0	0
4320030	0	0	N/A	0	2	1	N/A	1	0	0	N/A	0
4320041	0	0	0	0	1	1	1	1	0	0	0	0
4320050	0	0	0	0	1	1	1	1	0	0	0	0
4320180	0	0	N/A	0	4	1	N/A	4	1	0	N/A	1
4330035	0	N/A	N/A	N/A	0	N/A	N/A	N/A	1	N/A	N/A	N/A
4330060	0	N/A	N/A	0	1	N/A	N/A	1	0	N/A	N/A	0
4330115	0	0	N/A	0	0	0	N/A	0	1	1	N/A	1
4330150	0	0	0	0	0	0	0	0	2	2	2	2
4350030	0	N/A	0	0	2	0	2	2	0	N/A	0	0
4350031	0	N/A	N/A	N/A	1	N/A	N/A	N/A	0	N/A	N/A	N/A
4350037	0	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	1
4380120	0	0	N/A	0	3	3	N/A	3	0	0	N/A	0

Road Number	Number Stream Classes Crossed											
	Class I				Class III				Class IV			
	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 2	Alt. 3	Alt. 4	Alt. 5
4380200	3	N/A	N/A	3	0	N/A	N/A	0	0	N/A	N/A	0
4380290	1	N/A	N/A	1	1	N/A	N/A	1	0	N/A	N/A	0
7300115	0	N/A	N/A	0	1	N/A	N/A	1	0	N/A	N/A	0
7302012	1	N/A	1	1	1	N/A	1	1	0	N/A	0	0
7302019	0	0	0	0	0	0	0	0	2	2	2	1
7307025	0	N/A	0	0	1	0	1	1	0	N/A	0	0
7307050	0	0	0	0	2	2	2	2	0	0	0	0
7312014	0	0	0	0	4	4	4	4	0	0	0	0
7312100	0	0	N/A	0	1	0	N/A	1	3	3	N/A	3
7312127	0	N/A	N/A	N/A	1	N/A	N/A	N/A	0	N/A	N/A	N/A
7312129	0	N/A	N/A	0	4	N/A	N/A	4	0	N/A	N/A	0
7312150	0	N/A	N/A	0	0	N/A	N/A	0	1	N/A	N/A	1
7312160	0	N/A	N/A	0	5	N/A	N/A	5	0	N/A	N/A	0
7312185	0	N/A	N/A	0	3	N/A	N/A	3	0	N/A	N/A	0

Road Number	Number Stream Classes Crossed											
	Class I				Class III				Class IV			
	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 2	Alt. 3	Alt. 4	Alt. 5
7312187	0	N/A	N/A	0	3	N/A	N/A	3	0	N/A	N/A	0
7312200	0	0	N/A	0	2	2	N/A	2	0	N/A	0	0
7315000	0	N/A	N/A	0	2	N/A	N/A	2	0	N/A	N/A	0
7315035	1	N/A	N/A	1	1	N/A	N/A	1	0	N/A	N/A	0
7320000	0	0	0	0	1	1	1	1	0	0	0	0
7320020	0	0	N/A	0	0	0	N/A	0	1	1	N/A	1
	7	**1**	**1**	**7**	**56**	**23**	**15**	**52**	**26**	**18**	**9**	**20**

Class I=fishbearing, Class III=perennial non-fishbearing, Class IV=intermittent non-fishbearing

NA=Not Applicable since road would not be opened and no stream class crossings would occur.

Table 11 - Miles of Closed Road to be Opened in RHCA Buffers by Alternative

Road Number	Miles			
	Alternative 2	Alternative 3	Alternative 4	Alternative 5
4300720	.28		.28	.28
4330115	.04	.04		.04
4330150	.13	.13	.13	.13
4350030	.22		.22	.22
4350031	.10			
7312100	1.15	.76	.05	1.15
7312127	.11			
7312129	.26			.26
7312150	.61			.61
7312160	.66			.66
7312185	.30			.30
7312187	.18			.18
7312200	.32	.32		.32
7320000	.26	.13	.26	.26
7320200	.15		.15	.15
7300100	.08		.08	.08
7300115	.06			.06
7300140	.23	.23	.23	.23
7302012	.21		.21	.21
7302018	.03	.03	.03	.03
7302019	.19	.19	.19	.19
7307025	.10		.10	.10
7307050	.27	.26	.27	.27
7307075	.14	.14	.14	.14
7312014	.31	.31	.31	.31
4380030	.15	.15		.15
4380080	.26	.26		.26
4380120	.53	.52		.53
4380200	1.16			1.16
4380202	.11			.11
4380290	.21			.21
4380350	.09			.09
4380700	.04	.04	.04	.04
7300140	.20	.20	.20	.20
7300146	.18	.18	.18	.18
7312142	.45	.45	.45	.45
7312143	.02	.02	.02	.02
7312144	.09	.09	.09	.09
7315000	.37			.37
7315035	.33			.33
7320020	.04	.04		.04
4300350	.52	.52		.52
4300370	.96	.96		.86
4300400	.04			.04
4300411	.18	.18		.18
4300420	.42			.42
4300450	1.56			1.56
4300455	.04	.04		.04
4300515	.08	.08		.08
4300034	.11			
4300036	.05			
4300037	.10	.10		.10
4300073		.18		
4300140	.37	.37		.37
4300188	.18	.18		.18

Road Number	Miles			
	Alternative 2	Alternative 3	Alternative 4	Alternative 5
4300235	.14	.14		.14
4300330	.36	.36		.36
4315050	.06	.06		.06
4315700	.05	.05		.05
4315710	.07	.07		.07
4315800	.62	.62	.62	
4315900	.43	.43	.43	
4315930	.04	.04	.04	
4315940	.03	.03		
4316085	.05		.05	.05
4316100	.08	.08	.08	.08
4320030	.20	.08		
4320041	.06	.06	.06	.06
4320030				.08
4320050	.10	.10	.10	.10
4320180	.49	.16		.49
4330035	.08			.05
4330060				.42
4330063	.02			.02
4350036	.13	.13		.13
4350037	.32			.32
Total	**19.20**	**9.53**	**4.94**	**17.29**

Road Decommissioning

Alternatives 2, 3, 4, and 5 propose the decommissioning of 31.3 miles of road as part of the Post Sale Road Management Plan. These roads would be decommissioned, returned to resource production and removed from the road system.

The roads identified for decommissioning are overgrown and naturally decommissioned. Naturally decommissioned roads would not require actions beyond removing the road sign and removing the road from the transportation system. Road decommissioning activities would take place when road conditions are dry. There are no indirect effects to water quality or stream temperature from road decommissioning.

Summary of Effects to Water Quality and Stream Temperature from Action Alternatives

- Commercial harvest units would have RHCA buffer widths implemented as no activity stream buffers. These would prevent direct and indirect effects to water quality and stream temperature throughout the project area.
- Hand treatment only within RHCAs combined with no activity stream buffers will prevent direct and indirect effects to water quality and stream temperature.
- Minimum no activity stream buffers for handwork proposed for fishbearing streams is based on the riparian microclimate and the prescription is for thinning only. Handwork within RHCAs would not result in an increase in sediment yield to streams, and would decrease stream shade or alter stream temperatures.
- There will be no direct ignition for prescribed fire within RHCAs.
- Alternatives 2, 4, and 5 proposed new and existing wheel track temporary roads located in RHCAs, which will have indirect effects to water quality.
- Alternatives 2, 4, and 5 all propose temporary roads that would require installation and removal of culverts on Class I, III and IV stream crossings. This would have direct effects on water quality.

- All alternative proposed use of drawbottom roads that are closed and proposed to be open. This will have indirect effects to water quality and direct effects to water quality where culvert installation is necessary.
- Alternative 2 and 5 would have a greater degree of indirect effects to water quality than Alternative 3 and 4 since there are more stream crossings on closed roads opened for administrative project use. Alternatives 2 and 5 would open closed roads that cross 7 Class I fishbearing streams, Alternatives 3 and 4 would cross 1 Class I fishbearing stream.
- All Alternatives propose use of open and closed roads that require full reconstruction within RHCAs. Alternative 2 and 5 have the highest amount of miles to be reconstructed within RHCAs.
- All alternatives propose culvert replacement on road 4316800 where it crosses Wolf Creek, this would have direct short term effects on water quality. Alternative 2 and 5 would use T-26 which would replace an existing log culvert on a Class I stream and remove it after project completion, this would have direct effects to water quality from associated instream work.
- All Alternatives propose bridge replacement on North Fork Anthony Creek 7312. This is a Class I stream and removing and installing a bridge would have direct effects on water quality. If two pieces of equipment are used and no stream crossings with heavy equipment are necessary to install bridge, effects could be indirect in nature.
- Stand and fuels treatment adjacent to RHCAs and handwork within RHCAs would maintain/enhance the long term source (> 20 years) of large wood recruitment within RHCAs and stream channels.
- Treatment of stands, fuels reduction, and RHCA treatments will reduce the risk of a high intensity fire that could lead to the loss of stream shade, which could lead to elevated stream temperatures.
- All Alternatives would decommission 38.5 miles of road, some of these miles are in RHCAs, this will have an overall beneficial effect on water quality, improving watershed drainage.

Cumulative Effects to Water Quality

Potential cumulative effects are analyzed by considering the proposed activities in the context of present and reasonably foreseeable future actions. Reasonably foreseeable future actions are defined as within the next 5 years. Appendix D summarizes the present and reasonably foreseeable management activities that will occur in the cumulative effects analysis area and the determination of cumulative effects for water quality.

The logical area for cumulative effects to occur would be in the Middle North Powder, Upper Anthony Creek, Lower Anthony Creek, Upper Wolf Creek, Upper Ladd Creek, and Upper Beaver Creek Subwatersheds. This is where the majority of the East Face project activities are located and where cumulative effects could occur.

ALTERNATIVE 1 – NO ACTION

The potential cumulative effect to the subwatershed from the non-treatment of fuels and stands is an increased risk of high intensity fire that could potentially increase sediment yield to fishbearing streams, decrease stream shade, and reduce future recruitment of large wood to stream channels and RHCAs.

ALTERNATIVES 2, 3, 4 and 5

Project activities may contribute to cumulative effects since some short term sediment delivery above normal rates for the watershed is expected in Class I streams in the project area from road related activities in East Face alternatives (refer to direct and indirect effects on water quality and fisheries).

Logging on adjacent state and private lands overlap in time and space with the East Face cumulative effects analysis area and have the potential to contribute short term increases in sediment to streams due to temporary road construction, reconstruction, and new road construction to facilitate log haul. While the Oregon Forest Practices act provides for riparian protection measures, these are less restrictive than those on adjacent Federal lands. In addition to the logging on state and private lands, the Limber Jim Fuels reduction project opens 47 miles of closed road which is adjacent to the northwestern portion of the project area. Twelve miles of those roads to be opened are within RHCA buffers. These effects are expected to be short in duration lasting for the amount of time in-water work occurs and until sediment is flushed downstream in the case of culvert installation and removal in or upstream of fish bearing streams, the amount of time closed roads receive traffic over stream crossings.

In addition, 3,643 acres of adjacent private lands are receiving precommercial thinning treatments, slashbusting, machine piling, and pile burning treatments currently with an additional 2,200 acres scheduled to be funded and begin in 2015/2016. These areas in addition to the timber stand improvement work in the East Face area, Limber Jim Fuels Reduction area, and the Blue Mountain Elk Initiative area would improve stand health, vigor, and sustainability across the landscape reducing susceptibility to insects and disease and increasing the long term potential for large woody debris recruitment to streams and RHCAs.

Although it would not be detectable at a subwatershed scale in this project area, the Wallowa-Whitman Travel Management Plan would manage motor vehicle use restricting it to designated roads, trails, and areas which would have the potential to minimize direct and indirect effects to water quality and fisheries resources resulting in beneficial effects.

There are five grazing allotments within the cumulative effects analysis area. Three are BLM and two are Forest Service, one Forest Service allotment is vacant and there are no plans to restock within the next five years. Improved management (primarily fencing and grazing strategies) for domestic livestock grazing have reduced impacts to riparian areas and stream channels due to the implementation of PACFISH/INFISH standards and guidelines. Vegetation management activities in East Face may open up stands and allow livestock to move through currently dense stands more easily increasing access to riparian areas previously not accessible to livestock and wild ungulates. There may be a potential for isolated instream impacts due to this increased access which would require site specific increased administration by the permittee where needed.

B. Effects to Fish Habitat and Populations

Direct Effects on Fish Habitat and Populations

ALTERNATIVE 1 - NO ACTION

There are no direct effects on instream fish habitat or populations as a result of the No Action alternative. Effects related to this alternative on fish habitat and populations are indirect.

ALTERNATIVES 2, 3, 4 and 5

Commercial Removal

Alternative 2 proposes the commercial harvest of 6,722, Alternative 3 proposes the commercial harvest of 3,879 acres, Alternative 4, 2844 acres and Alternative 5, 10,221 acres using ground based equipment, skyline yarding and helicopter removal. Commercial Harvest units along fishbearing streams (HIM, HOR,

HPO, HPO/HIM, HSA, HSH, and HTH units) would have PACFISH RHCA widths implemented as no activity stream buffers. These will prevent direct effects to fish and fish habitat.

There is no difference in the direct effects to fish habitat and fish populations between Alternative 2, 3, 4 and 5 as a result of commercial removal.

Fire Fuels Treatment (FFU) Outside of RHCAs

Alternative 4 propose 90 acres of fire fuels treatment in units 46, 66 and 147, see Table 3 for FFU treatments by subwatershed. FFU units outside of RHCAs include mechanical treatment, and PACFISH RHCA widths would be implemented as no activity stream buffers. These will prevent direct effects to fish and fish habitat.

There is no difference in the direct effects to fish habitat and fish populations between Alternative 2, 3, 4 and 5 since no FFU treatments are included within RHCAs. There are no direct effects to fish habitat and fish populations from FFU treatments in Alternative 4.

Hand Fuel Reduction Treatments Within RHCAs

Alternative 2 and 4 propose 753 acres of fuels reduction work by hand in RHCA's, Alternative 3 proposes 612 acres and Alternative 5 proposes 747 acres. Implementation of a minimum 50 foot no activity stream buffer on fishbearing streams would prevent direct effects to fish habitat and fish populations in Alternatives 2, 3, 4 and 5 as a result of hand fuels reduction activities within RHCAs.

Precommercial Thinning (PCT) Within RHCAs

All PCT treatments within RHCAs would be hand treatments. Alternative 2 and 4 propose 238 acres of precommercial thinning (PCT units) in old harvest units within RHCAs. Alternative 3 proposes 225 acres of PCT within RHCAs, and Alternative 5 proposes 45 acres of PCT within RHCAs, see Table 4 for acres of PCT treatments in RHCAs by subwatershed for each alternative. As described under water quality, pre-commercial thinning hand treatments within RHCAs minimum no activity stream buffers of 50 feet on fishbearing stream channels (Class I) would prevent direct effects to fish and fish habitat.

There is no difference in the direct effects to fish habitat and fish populations between Alternative 2, 3, 4, and 5 as a result of precommercial thinning within RHCAs.

Prescribed Fire

Both Alternative 2 and Alternative 5 propose 6,685 acres of prescribed fire (actual burn area). Alternative 4 proposes 6,643 acres and Alternative 3 proposes 6,043 acres. Prescribed burning would occur when weather and fuel conditions are appropriate to meet the objectives and prescription. There would be no direct ignition within PACFISH RHCAs, but fire would be allowed to back into RHCAs. The fire intensity is expected to be low in riparian areas, having little effect on riparian conditions. There would be no direct effects to fish or fish habitat from the implementation of Alternative 2, 3, 4, or 5 in regard to prescribed fire.

There is no difference in the direct effects to fish habitat and fish populations between Alternative 2, 3, 4, and Alternative 5 as a result of prescribed fire.

Temporary Roads

Alternative 2 proposes the use of 12.62 miles of temporary road, 6.01 miles are existing wheel tracks and 6.61 miles are new miles that would be constructed for project use. Alternative 3 does not require temporary roads and therefore would have no direct effects to fish habitat and fish populations. Alternative 4 proposes 2.62, .67 miles on existing wheel tracks and 1.95 miles of new construction and Alternative 5 proposes the use of 14.71 miles of temporary road, 6.57 on existing wheel tracks and 8.14 miles of new temporary roads. Alternative 4 would require culvert installation on one Class III perennial non fishbearing stream and two Class IV intermittent streams and would not have any direct effects on fish habitat and fish populations. Alternatives 2 and 5 propose use of existing temporary road T-26. This road crosses Class I ESA listed bull trout stream, East Fork of Indian Creek. There is a log culvert at this crossing, which would be removed after project activities are completed in units 113 and 114.There would be short term, localized direct effects to water quality, which could directly affect fish during in water work associated with removing this culvert. Short term sediment input into the channel would occur from mechanical removal. See discussion on short term sediment impacts to water quality from culvert removals on page 18. Culvert removal would occur during ODFW in water work window guidelines (2008) to minimize effects to fish. Removing this structure will ultimately benefit fish passage and prevent potential impediments to fish passage at this crossing in the future.

Closed Roads for Administrative Use

The miles of closed roads proposed to be opened for administrative use is 107 miles for Alternative 2, 66.9 miles for Alternative 3, 38.6 miles for Alternative 4 and 122.7 miles for Alternative 5. Under all action alternatives, 6.5 miles of closed road would remain open after project completion.

Table 10 shows the closed roads to be opened, and stream classes that these roads cross. All alternatives propose to open roads that cross fish bearing Class I streams. Alternatives 2 and 5 have closed roads proposed to be open that cross 7 fish bearing streams, Alternatives 3 and 4 would open roads and cross 1 fish bearing stream. Road 4380200 proposed to be opened in Alternative 2 and 5 alone crosses 3 Class I fish bearing streams. There would be potential for effects to fish by opening these closed roads and increasing traffic and haul, but expected effects would be introducing sediment into channels from road use and would be indirect in nature. In addition, maintenance of closed roads would be required under all action alternatives.

Alternatives 2 and 5 would have the greatest potential effect on fish habitat or fish populations due to the 7 fishbearing Class I crossings. Alternatives 3 and 4 would have the least amount of direct effect on fish or fish habitat, but still have the potential for some effect due to the 1 Class I stream crossing.

Road Decommissioning

Alternatives 2, 3, 4, and 5 would decomission 31.3 miles nonsystme roads in the project area as part of the post-sale road management plan.

The roads identified for decommissioning are overgrown and naturally decommissioned. Naturally decommissioned roads would not require actions beyond removing the road sign and removing the road from the transportation system. There are no direct effects to fish and fish populations from road decommissioning. Decomissioning roads may include some of the following, installation of erosion control devices, subsoiling to reduce soil compaction, seeding, and blocking or camofoaging roads to discourage future use.

There is no difference in the direct effects to fish habitat or fish populations with the implementation of Alternative 2, 3, 4 and 5 in regard to road decommissioing.

Wolf Creek Culvert Replacement

Replacing the culvert on road 431680 that crosses Wolf Creek is proposed in Alternatives 2, 3, 4 and 5. Wolf Creek is a Class I fishbearing stream with ESA listed bull trout and redband rainbow trout. The existing culvert is inadequate for fish passage. Culvert replacement would have overall beneficial effects to fish passage and improve access for fish to upstream habitat, however there would be a short term increase in sediment and turbidity during and after instream work associated with removing and installing the new culvert. There would be a short term direct effect to water quality. The site would be dewatered at the time of construction to decrease effects to fish and water quality during in-water work. When the site is rewatered initially, sediment delivery may occur having short term effects on downstream fish and habitat. See discussion under water quality above regarding culvert installation and sediment. This culvert replacement would have an overall indirect beneficial effect to fish habitat and fish populations by improving passage to 5.2 miles of upstream habitat. There is no difference in effects between action alternatives since every alternative proposes culvert replacement on Wolf Creek.

This culvert will be replaced during the instream work window July 1-August 31 specified in Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources (2008) for Wolf Creek.

North Fork Anthony Creek Bridge Replacement

The 7312 road is a primary haul route for the East Face project area. Due to weight limitations which will not support log haul on the bridge on the 7312 road over the North Fork of Anthony Creek, the old bridge would be physically removed and a new bridge would be installed. Removal of the existing bridge and installation of the new bridge could have short term direct effects on fish habitat or populations if any equipment enters the channel or excavator work is necessary to build slopes and abutments. North Fork Anthony Creek is a Class I fishbearing stream with ESA listed Bull Trout, redband and brook trout. Effects would be the same in Alternatives 2-5.

Indirect Effects to Fish Habitat and Fish Populations

ALTERNATIVE 1 - NO ACTION

With the non-treatment of stands and fuels treatments, fuel conditions in stands, both fuel loadings and accumulation, will be excessive and the likliehood of a high intensity fire occuring is high. Fires have the potential to damage adajcent stands and RHCAs reducing the amount of large wood to streams needed for habitat formation, defoliate trees leading to increases in stream temperature, and could increase sediment yield to streams.

With the No Action Alternative, pre-commercial thinning would not occur and stands would remain overstocked. If left untreated, overstocked stands and RHCAs would stagnate, and tree diameters would remain in lower size classes (an average of less than eight inches dbh) until a disturbance occurs such as fire, insect infestation or disease.

An increase in sediment yield to streams resulting from wildfire can have potential negative effects to the growth and survival of salmonids. Increased concentrations of sediments and increased sedimentation rates can negatively affect spawning habitat, rearing habitat, overwintering habitat, and cause lethal effects to salmonids through increased egg mortality, reduced egg hatch, a reduction in the successful emergence of larvae (fry), and sediment induced death of juvenile and adult fish (Anderson, 1996).

Intense fires and related events have killed fish (Bozek and Young 1994) and even caused local extinctions (Propst et al. 1992, Rinne 1996). Large and intense fires could threaten populations of sensitive salmonids such as bull trout, Chinook salmon, steelhead, and others that are depressed from other causes (Rieman et al. 1995). The magnitude and intensity of recent fires heighten concerns regarding forest/ecosystem health and the apparent threat to sensitive species. Effects from forest fires in three study watersheds in the Boise National Forest during 1992 and 1994 included increased surface erosion and large pulses of fine sediment throughout systems following the first year of the event (Rieman et al. 1995). In many cases pools were virtually filled with new material, although pools in higher gradient channels often remained relatively free of sediment. In reaches with high intensity burn effects, shading from riparian cover was virtually eliminated. Woody debris in stream channels was often burned as well.

High intensity fire within and adjacent to RHCAs has the potential to reduce the long term recruitment of large wood to stream channels needed for the formation of fish habitat. The pulse of snags, logs, and coarse wood generated by a stand replacement fire is the recovering forest ecosystem's sole source of coarse wood until the new stand begins to generate snags and logs of comparable size and heartwood content, which generally takes 150 to 200 years in some forest types (Maser et al. 1988, Franklin et al. 2002, Harmon et al. 2004). Fire effects in low order streams are likely to have consequnces for the riparian environment throughout the downstream system. The consumption of woody debris by fires in low order streams may deprive downstream reaches of this important ecological asset (Gregory et al. 2003, Gurnell et al. 2005, Pettit and Naiman 2005, Latteral and Naiman 2007). Excessive heat from fires has the potential to cause soil sterility, thereby reducing future regeneration success. Severe site conditions can slow natural regeneration of coniferous trees following a stand replacement burn (Noss et al. 2006).

ALTERNATIVES 2, 3, 4 and 5

Indirect Benefits to Fish Habitat and Fish Populations

The primary benefit to fish habitat and fish populations is the long term maintenance/enhancement of large wood recruitment to stream channels needed for structure for the formation of fish habitat, sediment retention, riparian function, and reduced risk of a high intensity wildfire in RHCAs that could increase sediment yield to fishbearing streams as well as defoliate trees leading to an increase in stream temperatures.

Sediment delivery following forest operations and prescribed fire with forested buffers are a magnitude or more lower than following wildfire, and the increased number of disturbances from active forest management result in lower long term average sediment delivery rates than would occur following less frequent wildfire disturbances (Elliot and Robichaud 2001).

Precommercial thinning would reduce stocking densities in overstocked stands to reduce risk of disease and insect infestation leaving the healthiest and most vigorous trees that meet species and stocking requirements. This would result in larger trees with fuller crowns in the RHCA for stream shade and recruitment to stream channels and hillslopes for sediment retention and channel structure. In addition, there would be a decreased risk of insect and disease infestation in adjacent stands, including those portions of stands in the RHCA, which could contribute to higher fire intensities than those that would have occurred historically leading to a long term reduction of a large wood recruitment and potential increase in sediment yield to fishbearing streams.

Silvicultural systems can improve the overall vigor of some stream ecosytems and provide a long term supply of forest structural components for streams and riparian forests (Swanson and Berg 1991). Thinning stands adjacent to streams allows for the improvement of stand vigor without deleterious impact

to aquatic production. Increased growth of selected trees to be retained improves future sources of large wood. Thinning early increases diameter growth and concentrates volume growth on fewer stems (Berg 1995). Rentmeester (2004) conducted a thinning study focused on the production of snags as the primary recruitment mechanism along mainstem stream channels. Results indicate that silvicultural thinning resulted in increased diameter growth within residual trees. Faster diameter growth meant that trees were larger when they died and therefore the number of snags above the target diameter was greater. The abundance of large diameter snags increased by 20-74% under thinning scenarios in comparison to “no touch” silviculture.

Commercial Harvest

Commercial removal includes HFU, HIM, HOR, HPO, HSA, HSH, and HTH units. Alternative 2 proposes the commercial treatment of 6,722 acres, Alternative 3 proposes the commercial treatment of 3,879 acres, Alternative 4 proposes the commercial treatment of 2,844 acres and Alternative 5 proposes the commercial treatment of 10,221 acres using ground based equipment, skyline yarding and helicopter. All commercial harvest units adjacent to fish bearing streams would have PACFISH RHCA widths implemented as no activity stream buffers. PACFISH RHCA widths will prevent indirect effects to fish habitat and fish populations.

There is no difference in the indirect effects to fish habitat and fish populations between Alternative 2, 3, 4, and 5 in regard to commercial harvest.

Fire Fuels Treatment (FFU) Outside of RHCAs

Alternative 4 propose 90 acres of fuels reduction (FFU units) outside of RHCAs. Fuels reduction outside of RHCAs includes mechanical treatment using a slash buster (mastication) and piling slash with a grapple pile machine. For FFU units outside of RHCAs, PACFISH RHCA widths will be implemented as no activity stream buffers and would prevent indirect effects to fish habitat and fish populations. See Table 3 for acres of FFU by subwatershed for Alternative 4.

There is no difference in the indirect effects to fish populations and fish habitat between Alternative 2-5 since 2, 3, and 5 have no FFU units and all units in Alternative 4 will treat only outside of RHCA buffers.

Hand Fuel Reduction Treatments Within RHCAs

Alternative 2 and 4 propose 753 acres of fuels reduction work by hand in RHCA’s, Alternative 3 proposes 612 acres and Alternative 5 proposes 747 acres, see Table 5 for acres proposed by subwatershed in each alternative. A minimum 50 foot no activity stream buffer on fishbearing streams would prevent indirect effects to fish and fish habitat. Hand treatment within RHCAs would not result in sediment yield to streams, and would not alter stream temperatures since no overstory is being removed.

There is no difference in the indirect effects to fish habitat and fish populations between Alternative 2, 3, 4, and 5 in regard to fuels reduction handwork within RHCAs because minimum no activity stream buffers on fishbearing streams would be implemented.

Precommercial Thinning Outside of RHCAs

Alternative 2 proposes 3209 acres of PCT outside of RHCAs, Alternative 3 proposes 31457 acres of PCT outside of RHCAs, Alternative 4 proposes 6,447 acres of PCT outside of RHCAs and Alternative 5 proposes 3401 acres of PCT outside of RHCAs. Precommercial thinning outside of RHCAs includes mechanical treatment such as the use of a slashbuster and mechanical grapple piling of slash. Since precommercial thinning outside of RHCAs includes mechanical treatment, PACFISH RHCAs will be

implemented as no activity stream buffers and will prevent indirect effects indirect effects to fish habitat and fish populations. Class I fishbearing streams would receive 300 feet RHCA buffers.

There is no difference in the indirect effects to fish habitat and fish populations between Alternative 2, 3, 4 and 5 in regard to precommercial thinning outside of RHCAs.

Precommercial Thinning Within RHCAs

Alternative 2 and 4 propose 238 acres of precommercial thinning (PCT units) in old harvest units within RHCAs. Alternative 3 proposes 225 acres of PCT within RHCAs; Alternative 5 proposes 45 acres of PCT within RHCAs. A minimum 50 foot no activity stream buffer on fishbearing streams would prevent indirect effects to fish and fish habitat, and is based on the riparian microclimate. Precommercial hand thinning treatment within RHCAs is similar to hand fuels reduction work in RHCAs, and indirect effects to water quality and stream temperature are the same. See indirect effects to water quality for fire fuels hand treatment within RHCAs for analysis of effects. Hand treatment within RHCAs would not result in sediment yield to streams, and would not increase stream temperatures.

There is no difference in the indirect effects to fish habitat and fish populations between Alterantive 2, 3, 4 and 5 due to the implementation of minimum no activity buffers in all action alternatives.

Prescribed Fire

Alternative 2 proposes 6,685 acres of prescribed fire, Alternative 3 propose 6,043 acres, Alternative 4 proposes 6,643 and Alternative 5 proposes 6,685 acres (actual burn area). Prescribed burning would occur when weather and fuel conditions are appropriate to meet the objectives and prescription. Prescribed burning would be accomplished within a 10 year period depending on environmental conditions needed to meet burning prescriptions. There will be no direct ignition within PACFISH RHCAs, but fire would be allowed to back into RHCAs.

Because no direct ignition would be allowed within RHCAs no indirect effects to fish habitat or fish populations are expected with the implementation of Alternatives 2, 3, 4, and 5.

The use of prescribed fire will not increase stream temperatures. There will be no direct ignition within PACFISH RHCAs, but fire will be allowed to back into RHCAs. The fire intensity is expected to be low in riparian areas, having little effect on riparian vegetation or the conifer overstory.

There is no difference in the indirect effects to fish habitat and fish populations between Alternative 2, 3, 4, and 5 as a result of prescribed fire.

Temporary Roads

Alternative 2 proposes the use of 12.62 miles of temporary road, 6.01 miles are existing wheel tracks and 6.61 miles are new miles that would be constructed for project use. Alternative 3 does not require new or existing temporary road use. Alternative 4 proposes 2.62, .67 miles on existing wheel tracks and 1.95 miles of new construction and Alternative 5 proposes the use of 14.71 miles of temporary road, 6.57 on existing wheel tracks and 8.14 miles of new construction. Table 8 shows the miles of temporary roads in RHCA buffers by alternative and the number of stream crossings where culverts would be installed and removed.

Alternatives 2, 4, and 5 propose the use of temporary roads and all include miles within RHCA buffers. Alternative 2 proposes 2.01 miles of temporary road within RHCA buffers with 13 stream crossings and Alternative 5 proposes 2.46 miles of temporary road with 20 stream crossings. All of these stream

crossings would be installed for project use and removed after project use. Alternative 2 and 5 propose use of temporary road T-26, which crosses one Class I fishbearing stream over East Fork Indian Creek. There is currently a culvert in place, which would be removed after project activities.

Alternative 2 and Alternative 5 would have the greatest potential for indirect effects on fish populations and fish habitat due to one Class I stream crossing and log culvert replacement and removal at that crossing, which would cause short term sedimentation that could have direct and indirect effects on individual fish and fish habitat. These alternatives have over 2 miles of temporary road within RHCA buffers adjacent to fish streams (T-24 and T-25) and in draw bottom areas. Alternative 3 would have no indirect effect on fish populations or fish habitat and Alternative 4 would have minimal indirect effects since it does not propose to use roads T-24, T-25 and T-26, which are adjacent to Class I fishbearing streams and cross a Class I fishbearing stream. The temporary roads that have highest risk to fish populations and habitat due to their proximity to fish habitat that are proposed to be used in Alternatives 2 and 5 are T-24, T-25, T-26, T-22, and T-07. These are existing wheel tracks and therefore need less construction then the new temporary roads since the road bed already exists. These roads would be properly obliterated after completion of harvest activities in Alternatives 2 and 5, eliminating potential for future motor vehicle use and impacts fish and fish habitat in these areas. Under Alternatives 3 and 4, they would remain in present condition and could receive unmanaged vehicle use.

Alternatives 2 and 5 pose the most risk to water quality due to the over 2 miles of temporary road in RHCA buffers and adjacent to streams and the use of roads T-24, T-25, T-26, T-22 and T-07 as discussed above. Alternatives 2 and 5 would potentially have more indirect effect to water quality due to the locations of these roads and the 13 and 20 stream crossings that would receive additional sediment associated with erosion from opening roads, road maintenance, and hauling operations. It is important to note with these roads of concern that the road beds already exist as wheel tracks on the ground and some roads that are not vegetated in or blocked with berms may currently receive unmanaged motor vehicle use. In Alternatives 2 and 5 these roads would be properly obliterated after completion of the harvest activities, eliminating potential for future motor vehicle use and impacts in these areas.

The T-24 road is in the valley bottom and is in very close proximity to Class I bull trout stream for approximately 0.5 miles. The road is within 15-20 feet of Class I habitat until it splits with the T-25 and the T-25 is immediately adjacent to Class I habitat for another .25 miles. Temporary road T-26 crosses East Fork of Indian Creek, Class I habitat and is in the buffer of Class I crossing for 0.2 miles. Due to the proximity of this road to fish bearing habitat and Class III habitat immediately upstream of Class I habitat, using this road for hauling would cause a continued source of sediment while it is used to fishbearing Indian Creek and the east fork of Indian Creek. Temporary road T-22 along with T-20 and T-21 crosses Class III perennial streams (tributaries to Indian Creek) four times. The only crossing structure on this road is an old log culvert at the crossing as the road enters unit 104 and it plugged and collapsing and is causing water to run down the road. This structure will need to be replaced. If it plugged and blew out it would cause sedimentation to bull trout habitat below.

All temporary roads would be built, used, and restored during the dry season and during the same season of use. After use, temporary roads will be subsoiled where appropriate, returned to original contours where needed and wood debris scattered across the footprint of the temporary road where debris is available. All stream crossing structures would be removed from the road prism and drainage across the road prism would be addressed to restore stream network connectivity.

Alternatives 2 and 5 would have the greatest potential for short term indirect effects to fish populations and fish habitat due to crossing a Class I stream, overall number of stream crossings, and proximity of roads proposed for use and haul to fish habitat and within RHCA buffers. Alternative 3 would have no

indirect effect on fish populations and fish habitat and Alternative 4 would have the least amount of indirect effect since it does not propose use of these temporary roads of concern discussed above; however, Alternatives 2 and 5 would properly obliterate these wheel tracks, which would eliminate motor vehicle use in the future.

Closed Roads Used For Administrative Purposes

As described under the water quality indirect effects for closed roads to be opened for administrative use, the action alternatives propose opening 38.6 to 122.7 miles of roads with numerous stream crossings (tables 10 and 11).

There are miles of closed drawbottom roads which would be opened for project purposes in all Alternatives including 4315930 and 4300330. These roads are proposed to be used in Alternatives 2 and 3, 4315930 is also proposed to be used in Alternative 4 and 4300330 is proposed to be used in Alternative 5. Opening roads in these locations and using them for project activities and hauling increases indirect effects to fish and fish habitat due to the potential to increase sediment delivery to stream channels compared to utilizing roads to access units that are located in uplands and outside of RHCAs.

Maintenance of closed roads may be required for project use. Most maintenance activities on closed roads would not result in an adverse effect to fish habitat or fish populations. Maintenance includes brushing, spot rocking, blading and shaping of the road surface, cross drain culvert cleaning, and limited ditch cleaning. A culvert on road 7312160 on a perennial Class III non-fish bearing stream was removed and would need to be installed in Alternatives 2 and 5 since both of those alternatives propose using that road. This culvert installation is less than .25 miles upstream of the extent of bull trout habitat. It is unknown how many other culverts on closed roads will need to be replaced or installed to open closed roads for project access and use. Any culvert installation on Class I and III (perennial streams) will have direct effects on water quality.

At all other stream crossing sites on closed roads road maintenance activities would result in a non-measurable amount of sediment reaching fishbearing streams due to distance to occupied habitat, limited maintenance proposed, and use of roads during dry or frozen conditions.

Sedimentation to stream channels above existing levels is expected, however roads would be used only under dry and frozen conditions and established vegetation on the road margins, sides of the road prism, and in ditches would be retained to filter and trap sediment. These mitigation measures are expected to limit sediment input into streams form project use and hauling.

Alternatives 2 and 5 have more stream crossings on closed roads opened for project use including Class I fishbearing streams, and therefore these alternatives have a greater potential for sediment yield to fishbearing streams than Alternatives 3 and 4. Indirect effects to fish and fish habitat would occur during the time the roads are reconstructed, maintained, opened with traffic associated with project activities and haul and depending on the amount of sediment input could last until rain or snowmelt run off flushes it out. The greater the amount of traffic on the roads for project activities, the greater the likely hood for sediment to enter streams from normal road surface erosion. Because the majority of roads will be re-closed after project activities, the potential for sediment input to stream channels at stream crossings is limited to the amount of time the road is opened and driven for project activities and haul.

Road Decommissioning

Alternatives 2, 3, 4, and 5 propose the decommissioning of 31.3 miles of road as part of the Post Sale Road Management Plan. These roads would be decommissioned, returned to resource production and

removed from the road system.

Some of the roads identified for decommissioning are overgrown and already naturally decommissioned while others would need to be physically decommissioned. Naturally decommissioned roads would not require actions beyond removing the road sign and removing the road from the transportation system. Road decommissioning activities would take place when roads are dry. There are no indirect effetcs to fish and fish populations from road decommissioning. Decommissioning these roads would have an overall beneficial indirect effect to fish habitat and populations by restoring run off patterns and stream connectivity.

Summary of Effects to Fish Habitat and Populations from Action Alternatives

- Direct effects to fish habitat and fish populations are associated with in water work in Class I streams on North Fork Anthony Creek 7312 bridge replacement and Wolf Creek culvert replacement on 7316800. Effects are the same in Alternatives 2, 3, 4, and 5. These effects will be short in duration occurring for the amount of time equipment is in the channel or when the site is rewatered after equipment has worked at the dewatered site and sediment pulse is flushed downstream.

- Alternatives 2 and 5 propose using T-26 temporary road. This road has an existing log culvert on a Class I ESA listed bull trout stream. This log culvert removed after project activity access is no longer needed. Removing the existing culvert could have short term direct effects on individual fish and fish habitat.

- For FFU activities where mechanical treatment would occur, RHCA buffer widths would be implemented as no activity stream buffers. These will prevent direct and indirect effects to fish and fish habitat.

- Hand treatment within RHCAs combined with minimum no activity stream buffers would prevent direct and indirect effects to fish and fish habitat.

- No activity stream buffers for handwork proposed within RHCAs along fishbearing streams are based on the riparian microclimate.

- There would be no direct ignition of prescribed fire within RHCAs.

- All alternatives except Alternative 3 propose new and existing temporary roads within RHCAs, which could cause direct and indirect effects to water quality.

- In all alternatives there is the potential for sediment to reach fishbearing streams due to the location of reconstruction of roads in RHCA buffers, road miles traversing RHCA buffers, number of stream crossings on closed roads and number of fishbearing stream crossings in Alternatives 2 and 5.

- All Alternatives propose replacing the culvert on Wolf Creek, road 431680, which would have short term direct effects on fish from increase in sediment delivery during in water work, but would have an overall beneficial effect by improving fish passage to 5.2 miles of upstream habitat.

<u>Indirect Benefits to Fish and Fish Habitat</u>

- Primary benefits to fish habitat and fish populations from stand treatment, fuels treatment, and precommercial thinning is the long term maintenance/enhancement (> 20 years) of large wood recruitment to stream channels, and reduced risk of a high intensity wildfire in RHCAs that could

increase sediment yield to fishbearing streams as well as defoliate trees leading to an increase in stream temperatures.

- The culvert replacement on road 7316800 Wolf Creek would improve fish passage to 5.2 miles of habitat upstream of crossing.
- Decommissioning 31.3 miles of roads would improve stream connectivity and hydrologic function having an overall benefit to fish and fish habitat and potentially decreasing sediment input to streams at stream crossings.
- Alternatives 2 and 5 would remove an existing log culvert on a Class I stream on T-26. The culvert would be permanently removed after project use, this would have a long term beneficial effects to fish passage and connectivity to upstream habitat.

Cumulative Effects to Fish Habitat and Fish Populations

Potential cumulative effects are analyzed by considering the proposed activities in the context of present and reasonably foreseeable future actions. Reasonably foreseeable future actions are defined as within the next 5 years. Appendix D summarizes the present and reasonably foreseeable management activities that will occur in the cumulative effects analysis area and the determination of cumulative effects.

The logical area for cumulative effects to occur would be in the Middle North Powder, Upper Anthony Creek, Lower Anthony Creek, Upper Wolf Creek, Upper Ladd Creek, and Upper Beaver Creek Subwatersheds. This is where the majority of the East Face project activities are located and where cumulative effects could occur.

ALTERNATIVE 1 – NO ACTION

The potential cumulative effect to the subwatershed from the non-treatment of fuels and stands is an increased risk of high intensity fire that could potentially increase sediment yield to fishbearing streams, decrease stream shade, and reduce future recruitment of large wood to stream channels and RHCAs.

ALTERNATIVES 2, 3, 4 and 5

Project activities may contribute to cumulative effects since some short term sediment delivery above normal rates for the watershed is expected in Class I streams in the project area from road related activities in East Face alternatives. Potential cumulative effects to fisheries and fish habitat would be the same as those described under the water quality section above.

C. Aquatic Management Indicator Species Analysis

Introduction

The Wallowa-Whitman National Forest Land and Resource Management Plan identifies two fish species as Management Indicator Species (MIS). These include the redband /rainbow trout and steelhead (USDA 1990). These species were selected as they were considered to be good indicators of the maintenance and quality of instream habitats. These habitats were identified as high quality water and fishery habitat.

The NFMA regulations require that “fish and wildlife habitat be managed to maintain viable populations of existing …species in the planning area.” To ensure that these viable populations are maintained, the

Pacific Northwest Region of the Forest Service has identified management requirements for a number species within the region. These Management Indicator Species are emphasized either because of their status under ESA or because their populations can be used as an indicator of the health of a specific type of habitat (USDA 1990).

Riparian ecosystems occur at the margins of standing and flowing water, including intermittent stream channels, ephemeral ponds, and wetlands. The aquatic MIS were selected to indicate healthy stream and riparian ecosystems across the landscape. Attributes of a healthy aquatic ecosystem includes: cold and clean water; clean channel substrates; stable streambanks; healthy streamside vegetation; complex channel habitat created by large wood, cobbles, boulders, streamside vegetation, and undercut banks; deep pools; and waterways free of barriers. Healthy riparian areas maintain adequate temperature regulation, nutrient cycles, natural erosion rates, and provide for instream wood recruitment.

The fish bearing streams or portions of fish bearing streams in the project area that have MIS species include:

- Antone Creek
- Anthony Creek
- Indian Creek
- North Fork of Anthony Creek
- Dutch Creek
- Wolf Creek
- North Fork of Wolf Creek
- Third Creek
- East Fork of Clear Creek
- West Fork of Clear Creek
- Ladd Creek
- Shaw Creek
- Upper Beaver Creek
- Tributaries to Upper Beaver Creek
- North Powder River

Existing Condition

Habitat for MIS species, rainbow trout and redband trout, exists within the project area and is included in the analysis area. Table 12 below describes the MIS, the habitat they represent, and whether they are present in the project analysis area.

Table 12 - MIS and habitat description for the East Face project area.

MIS	Habitat Description	Habitat Present in Analysis Area	Species Present in Analysis Area
Rainbow Trout/ Redband Trout	Water quality/ Fish Habitat	Yes	Yes
Steelhead		No	No

Methods used to document fish distribution include field presence/absence surveys and aquatic inventory surveys.

Redband/Rainbow Trout

Redband trout are sensitive to changes in water quality and habitat. Adult redband trout are generally associated with pool habitat, although other life stages require a wide array of habitats for rearing, hiding, feeding and resting. Pool habitat is important refugia during low water periods. An increase in sediment in the stream channel lowers spawning success and reduces the quality and quantity of pool habitat. Other important habitat features include healthy riparian vegetation, undercut banks and large wood debris. The Wallowa-Whitman National Forest is utilizing this fish/habitat relationship to provide the basis for assessment of redband trout populations for the purposes of MIS assessment.

In the absence of redband trout population trend data, the Wallowa-Whitman National Forest has measured key habitat variables, and then assessed changes expected to occur as a result of project activities. This MIS analysis assumes that activities that maintain and improve aquatic/riparian habitat will provide for resident fish population viability on Wallowa-Whitman National Forest lands.

Habitat Condition – The Wallowa-Whitman National Forest has completed Forest Service Region 6 Stream Surveys in the majority of fish bearing streams in the East Face Project area. The stream survey protocol (based on the Hankin and Reeves survey methodology) guides collection of field data for stream channels, riparian vegetation, and fish presence. Data collected from these surveys are then rated using habitat indicator benchmarks developed by the National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS) (USDA, USDC, and USDI 2004), and compared to Forest Plan Riparian Management Objectives (RMOs). Measured habitat data is summarized in Table 12, and habitat rating by stream is summarized in Tables 13-23.

Table 13 – Habitat Summary Data for Class 1 Streams in the East Face Analysis Area

Stream Name	Wetted Width (ft)	Pools/Mile[1]	Pieces LWD/Mile	W/D Ratio[2]	Stable Banks (%)
Antone Creek	8.5	29	65	12.2	96
Anthony Creek	14.6	25	5	23.6	100
Indian Creek	5.0	47	49	5.7	100
North Fork Anthony Cr.	8.7	59	18	19.3	99
Dutch Creek	4.8	123	17	17.7	98
Wolf Creek	9.3	34	53	19.8	96
North Fork Wolf Cr.	6.9	51	74	13.5	100
East Fork Clear Cr.	6.5	95	47	23.3	95
West Fork Clear Cr.	4.2	106	29	13.0	97
Upper Beaver Creek	6.1	20	13	11.8	ND
RMO/Indicator	------	96 56 47	>20	<10	>90

1. RMO based on stream width. Wetted widths $\leq$ 10 feet = 96 pools/mile, wetted width 10 to 20 feet=56 pools/mile, wetted width 20 to 25 = 47 pools/mile.

ND=No Data

2. Width to depth ratios for all streams meet width to depth ratio as described for Rosgen stream types.

Middle North Powder Subwatershed

Antone Creek (Table 14) – Habitat conditions in Antone Creek are good. There are higher than desirable road densities in the subwatershed and low number of full channel spanning pools. Three culverts on the 7300 road are partial barriers to the upstream migration of fish. Percentage of stable streambanks and number of pieces of large wood meet RMO values. Maximum stream temperature in Atone Creek is thought to meet RMOs based on spot stream temperatures obtained during stream survey.

Table 14 - MIS habitat summary for Antone Creek.

Habitat Element	Value	Rating
Road Density (open and closed)	2.4 mi/mi^2 (subwatershed)	Functioning At Risk
Stream Temperature	<68.0^{0}F (RMO value)	Properly Functioning
Streambank Stability	>90% (RMO value)	Properly Functioning
Pool Frequency/Quality	96 pools/mi (RMO value)	Not Properly Functioning
Large Wood	>20 pcs/mi (RMO value)	Properly Functioning
Riparian Zone Vegetation	Some loss due to road crossings, but overall condition is good	Properly Functioning
Fish Barrier	Three culverts are partial barriers	Functioning At Risk

Upper Anthony Creek and Lower Anthony Creek Subwatershed

Anthony Creek (Table 15) - Habitat conditions in Anthony Creek are fair to good. There are higher than desirable road densities in the subwatershed, and low number of full channel spanning pools. There are lower than desirable number of pieces of large wood that may be attributed to the Anthony Burn forest fire that reduced recruitment of large wood to the stream channel. There is a high percentage of stable streambanks. Riparian zone vegetation is well developed and in good condition. There are two diversion structures that can be complete barriers during irrigation season. These are both located in the Lower Anthony subwatershed.

Table 15 - MIS habitat summary for Anthony Creek (Upper and Lower Anthony Subwatershed).

Habitat Element	Value	Rating
Road Density (open and closed)	Upper Anthony sub: 3.0 mi/mi^2 (subwatershed) Lower Anthony sub: 3.4 mi/mi^2 (subwatershed)	Not Properly Functioning
Stream Temperature	<53.6^{0}F (RMO value)	Functioning At Risk
Streambank Stability	>90% (RMO value)	Properly Functioning
Pool Frequency/Quality	96 pools/mi (RMO value)	Not Properly Functioning
Large Wood	>20 pcs/mi (RMO value)	Not Properly Functioning

Riparian Zone Vegetation	Good Condition	Properly Functioning
Fish Barrier	Two diversion structures	Functioning At Risk

Indian Creek (Table 16) - Habitat conditions in Indian Creek are rated as fair to good. There are higher than desirable road densities in the subwatershed, and low number of full channel spanning pools. There is a high percentage of stable streambanks, and number of pieces of large wood meets and exceeds the RMO value. Riparian zone vegetation is in good condition. There are two culverts that are compete barriers to the upstream migration of fish.

Table 16 - MIS habitat summary for Indian Creek (Upper Anthony Creek subwatershed).

Habitat Element	Value	Rating
Road Density (open and closed)	3.0 mi/mi^2 (subwatershed)	Not Properly Functioning
Stream Temperature	<53.6^{0}F (RMO value)	Functioning At Risk
Streambank Stability	>90% (RMO value)	Properly Functioning
Pool Frequency/Quality	96 pools/mi (RMO value)	Not Properly Functioning
Large Wood	>20 pcs/mi (RMO value)	Properly Functioning
Riparian Zone Vegetation	Some loss due to road crossings, but overall condition is good	Properly Functioning
Fish Barrier	Two culverts are complete barriers.	Not Properly Functioning

North Fork Anthony Creek (Table 17) - Habitat conditions in the North Fork of Anthony Creek is rated as good. There are higher than desirable road densities in the subwatershed, and low number of full channel spanning pools. There is a high percentage of stable streambanks. The number of pieces of large wood is slightly less than the RMO value of >20 pieces. Riparian zone vegetation is in good condition. There are no artificial barriers.

Table 17 - MIS habitat summary for N. Fk. Anthony Creek (Upper Anthony Cr. subwatershed).

Habitat Element	Value	Rating
Road Density (open and closed)	3.0 mi/mi^2 (subwatershed)	Not Properly Functioning
Stream Temperature	<53.6^{0}F (RMO value)	Functioning At Risk
Streambank Stability	>90% (RMO value)	Properly Functioning
Pool Frequency/Quality	96 pools/mi (RMO value)	Not Properly Functioning
Large Wood	>20 pcs/mi (RMO value)	Functioning At Risk
Riparian Zone Vegetation	Well developed and in good condition	Properly Functioning
Fish Barrier	No artificial barriers.	Properly Functioning

Dutch Creek (Table 18) - Habitat conditions in Bottle Creek are rated as poor to fair. There are higher than desirable road densities in the subwatershed, and slightly less than desirable amount of large wood. Maximum stream temperature in Dutch Creek is thought to meet RMOs based on spot stream temperatures obtained during stream survey. The number of pools per mile exceeds the RMO value of > 96 pools per mile. Habitat conditions in the approximate lower third of the fish bearing portion of Dutch Creek is in good condition. Above this point, the Carnes irrigation ditch bisects Dutch Creek. During irrigation season this ditch becomes a complete barrier to fish and a section of stream becomes dewatered. The approximate upper third of the fishbearing portion of Dutch Creek has a road crossing with a culvert. Upstream of the road crossing a draw bottom road exists along Dutch Creek imping upon the stream channel and riparian zone.

Table 18 - MIS habitat summary for Dutch Creek (Lower Anthony Cr. subwatershed).

Habitat Element	Value	Rating
Road Density (open and closed)	3.4 mi/mi^2 (subwatershed)	Not Properly Functioning
Stream Temperature	<68.0^{0}F (RMO value)	Properly Functioning
Streambank Stability	>90% (RMO value)	Properly Functioning
Pool Frequency/Quality	96 pools/mi (RMO value)	Properly Functioning
Large Wood	>20 pcs/mi (RMO value)	Functioning At Risk
Riparian Zone Vegetation	Loss due to irrigation ditch crossing and draw bottom road.	Functioning At Risk
Fish Barrier	Irrigation ditch crossing, dewatered channel, and one culvert.	Not Properly Functioning

Upper Wolf Creek Subwatershed

Wolf Creek (Table 19) - Habitat conditions in Wolf Creek are good. The subwatershed does have a high road density, but the majority of roads in the subwatershed are closed. The maximum stream temperatures in Wolf Creek exceeds the temperature standard by an approximate six degrees Fahrenheit. There is a lower than desirable number of full channel spanning pools. Sreambank stability is excellent with 96% stable streambanks. There is a high amount of large wood, and exceeds the RMO value. Riparian zone vegetation is well developed and in condition. There is one culvert that is a barrier to fish. This culvert is planned for removal or replacement under the East Face Project.

Table 19 - MIS habitat summary for Wolf Creek.

Habitat Element	Value	Rating
Road Density (open and closed)	6.6 mi/mi2 (subwatershed)	Not Properly Functioning
Stream Temperature	<53.60F (RMO value)	Functioning At Risk
Streambank Stability	>90% (RMO value)	Properly Functioning
Pool Frequency/Quality	96 pools/mi	Not Properly Functioning
Large Wood	>20 pcs/mi	Properly Functioning

Habitat Element	Value	Rating
Riparian Zone Vegetation	Well developed and in good condition.	Properly Functioning
Fish Barrier	One culvert	Functioning At Risk

North Fork of Wolf Creek (Table 20) - Habitat conditions in the North Fork of Wolf Creek are good. The subwatershed does have a high road density, but the majority of roads in the subwatershed are closed. The maximum stream temperature in the North Fork of Wolf Creek exceeds the state temperature standard which is for bull trout. However, there are no bull trout in the North Fork of Wolf Creek. There is a lower than desirable number of full channel spanning pools. There is a high percentage of stable streambanks, and adequate amounts of large wood. Riparian zone vegetation is in good condition. There are no artificial barriers in the North Fork of Wolf Creek.

Table 20 - MIS habitat summary for North Fork of Wolf Creek

Habitat Element	Value	Rating
Road Density (open and closed)	6.6 mi/mi2 (subwatershed)	Not Properly Functioning
Stream Temperature	<53.60F (RMO value) (state standard for bull trout)	Not Properly Functioning (no bull trout present)
Streambank Stability	>90% (RMO value)	Properly Functioning
Pool Frequency/Quality	96 pools/mi	Not Properly Functioning
Large Wood	>20 pcs/mi	Properly Functioning
Riparian Zone Vegetation	Impacted by draw bottom road.	Properly Functioning
Fish Barrier	No artificial barriers	Properly Functioning

East Fork of Clear Creek (Table 21) - Habitat conditions in the East Fork of Clear Creek are good. The subwatershed does have a high road density, but the majority of roads in the subwatershed are closed. The number of pools per mile meets the RMO value, there is a high percentage of stable streambanks, and the numerous pieces of large wood exceed the RMO value. Riparian zone vegetation is in good condition. There is one culvert that is a partial barrier to the upstream migration of fish.

Table 21 - MIS habitat summary for East Fork of Clear Creek.

Habitat Element	Value	Rating
Road Density (open and closed)	6.6 mi/mi2 (subwatershed)	Not Properly Functioning
Stream Temperature	$<68.0^{0}$F (RMO value)	Properly Functioning
Streambank Stability	>90% (RMO value)	Properly Functioning
Pool Frequency/Quality	96 pools/mi	Properly Functioning
Large Wood	>20 pcs/mi	Properly Functioning

Habitat Element	Value	Rating
Riparian Zone Vegetation	Good condition. Partially in the wilderness.	Properly Functioning
Fish Barrier	One culvert	Functioning at risk

West Fork of Clear Creek (Table 22) - Habitat conditions in the West Fork of Clear Creek are good. Maximum summer stream temperatures meet the state of Oregon temperature standard. There is a high percentage of stable streambanks, and number of pieces of large wood exceeds the RMO value. Riparian vegetation is well developed and is in good condition. There are no barriers to fish migration.

Table 22 - MIS habitat summary for West Fork of Clear Creek.

Habitat Element	Value	Rating
Road Density (open and closed)	6.6 mi/mi2 (subwatershed)	Not Properly Functioning
Stream Temperature	<68.0^{0}F (RMO value)	Properly Functioning
Streambank Stability	>90% (RMO value)	Properly Functioning
Pool Frequency/Quality	96 pools/mi	Properly Functioning
Large Wood	>20 pcs/mi	Properly Functioning
Riparian Zone Vegetation	Impacts from past harvest and roads	Properly Functioning
Fish Barrier	None	Properly Functioning

Upper Beaver Creek Subwatershed

Upper Beaver Creek (Table 23) - Habitat conditions in Upper Beaver Creek are fair. There are higher than desirable road densities in the subwatershed. Maximum summer stream temperatures likely exceed the state water quality standard. There is a lower than desirable number of full channel spanning pools. There are a less than desirable number of pieces of large wood, and may be due to a series of meadows in Upper Beaver Creek that lack streamside conifers. Riparian zone vegetation is in good condition. There is one culvert that is a complete barrier to upstream fish migration. There is an approximate 1.1 miles upstream of this culvert. Both redband trout and brook trout inhabit Upper Beaver Creek.

Table 23 - MIS habitat summary for Upper Beaver Creek.

Habitat Element	Value	Rating
Road Density (open and closed)	2.8 mi/mi2 (subwatershed)	Functioning at Risk
Stream Temperature	<60.8^{0}F (RMO value)	Functioning at Risk
Streambank Stability	>90% (RMO value)	No data
Pool Frequency/Quality	96 pools/mi	Not Properly Functioning
Large Wood	>20 pcs/mi	Not Properly Functioning
Riparian Zone Vegetation	Good condition.	Properly Functioning
Fish Barrier	One culvert	Functioning at Risk

The amount of occupied MIS habitat for redband trout on the Wallowa Whitman National Forest is approximately 1,310 miles (Table 26). Based on GIS analysis, the amount of MIS habitat for redband trout in the project area represents a fraction of the overall miles of redband trout habitat for the entire forest.

Table 24 - MIS distribution in the project area in relation to the Wallowa-Whitman National Forest.

MIS	Forest Distribution (mi)	MIS in Analysis Area (mi)	Proportion of MIS habitat in Project Area out of total on Forest
Rainbow Trout/ Redband Trout	1,310	33.1	2.5%

Effects of Implementation

The only direct effects to MIS fish species or habitat from the implementation of the East Face Project is the culvert replacement on Wolf Creek on the 4316800 road and the replacement of the 7312 bridge that crosses North Fork Anthony Creek, the removal of the log culvert on T26, and any other culvert replacements on closed roads that will be opened for administrative use that cross Class I streams. All other activities are away from fishbearing streams. No other activities associated with the East Face Project are proposed within fishbearing streams in the project area. Implementation of Standards and Guidelines in the Forest Plan as amended by Pac Fish (USDA/USDI 1994) and the East Face Project Design will avoid negative indirect effects to MIS fish species. MIS life stages present in the project area include juvenile, adult, and eggs. See Analysis of Effects on Fisheries and Watershed Resources for direct and indirect effects to fish and fish habitat.

Reduced sediment delivery improves important aquatic elements such as cleaner water, higher quality substrates for spawning and rearing habitat, and less pool infilling. Thinning densely stocked Riparian Reserve stands improves vegetation conditions, which leads to increased large wood recruitment and creates more fire resilient stands along streams. The cumulative effects are within the scope of anticipated effects to aquatic resources determined in the Wallowa-Whitman National Forest Land and Resource Management Plan (USDA 1990). For more information on cumulative effects for the Sandbox Project, see cumulative effects analysis in this document (Section 7).

Improved Conditions

The East Face Project will improve habitat conditions for the aquatic MIS in the project area through fuels reduction and thinning. Anthropogenic fine sediment delivery in the project area could decrease with project implementation as a result of road decommissioning, and properly closing temporary roads. In the long-term, there would be a reduction in artificially induced sediment entering the stream system, benefiting aquatic MIS and their habitat. In addition the culvert replacement on Wolf Creek on road 4316800 would improve fish passage to 5.2 miles of upstream habitat. Therefore, the project will not contribute to a negative trend in viability on the Wallowa-Whitman National Forest for these species.

D. Determination of Effect to Listed Fish, Fish Habitat and Sensitive Fish Species

ALTERNATIVE 1 – No Action

The No Action Alternative **May Affect,** but is **Not Likely to Adversely Affec**t Columbia River Basin bull trout or their designated critical habitat. These are primarily indirect effects due to non-treatment of stands that could lead to disease, insect infestation, increased risk of high intensity wildfire, increased sedimentation from wildfire, and suppression of conifers from competition that could lead to a decrease in large trees for future recruitment to the stream channel and stream shade. While there is a potential for negative affects to fish and habitat from increased sediment yield to fishbearing streams as a result of wildfire, the actual effects to fish and fish habitat is unknown so a **Not Likely to Adversely Affect** determination was reached for this alternative.

The No Action Alternative may impact redband trout individuals or habitat for this species, but is not likely to contribute to a trend towards federal listing or cause a loss of viability to the population or species.

ALTERNATIVES 2, 3, 4 and 5

Columbia Basin Bull Trout and Designated Critical Habitat

Alternative 2, 3, 4 and 5 **May Affect**, and **is Likely to Adversely Affect** bull trout or designated critical habitat for bull trout.

This determination is based on the following:

- Culvert replacement on Wolf Creek, Class I stream with Bull Trout to improve fish passage, direct short term effects increase insediment and turbidity when site is rewatered after construction associated with culvert removal, installation, instream channel work is proposed in all action alternatives. This will have the overall beneficial effect of improved passage to fish to 5.2 miles of upstream habitat.
- Bridge Replacement on 7312 North Fork Anthony Creek, Class I stream with Bull Trout
- All commercial harvest units adjacent to fish bearing streams would have PACFISH RHCA widths implemented as no activity stream buffers. PACFISH RHCA widths will prevent indirect effects to listed fish and designated critical habitat.
- For FFU activities where mechanical treatment would occur, PACFISH RHCA widths will be implemented as no activity stream buffers. These will prevent direct and indirect effects to listed fish and designated critical habitat.
- Hand treatment within RHCAs combined with minimum no activity stream buffers will prevent direct and indirect effects to fish and fish habitat.
- No activity stream buffers for handwork proposed within RHCAs along fishbearing streams are based on the riparian microclimate.
- There will be no direct ignition of prescribed fire within RHCAs.
- All action alternatives with the exception of Alternative 3 propose use of temporary roads which are within RHCAs and where culvert installation and removal is necessary having direct and indirect effects to water quality.
- Some amount of sediment would reach fishbearing streams from the use of closed roads that cross Class I streams, traverse RHCA buffers, and require reconstruction within RHCAs.

Mitigation will be used to minimize effects such as use of closed roads during dry or frozen conditions.

- Draw bottom roads would be opened for project use.

Redband Trout

Implementation of the East Face Project **may impact** redband trout individuals or habitat for this species, but will not likely contribute to a trend towards federal listing or cause a loss of viability to the population or species.

E. Findings - Water Quality Compliance Statement, Floodplains and Wetlands Executive Orders

1. Project Effects on Riparian Management Objectives

Landscape-scale interim RMOs describing good habitat for anadromous fish were developed using stream inventory data for pool frequency, large woody debris, bank stability, and width to depth ratio. State water quality standards were used to define favorable water temperatures. All of the described features may not occur in a specific segment of stream within a watershed, but all generally should occur at the watershed scale for stream systems of moderate to large size (3rd to 7th order).

RMOs are as follows:

Pool Frequency: (varies by wetted width)

Wetted width in feet:	10	20	25	50	75	100	125	150
Number of pools per mile:	96	56	47	26	23	18	14	12

Water Temperature: Compliance with state water quality standards, or maximum < 68F.

Large Woody debris: > 20 pieces per mile; >12 inches diameter; 35 foot length

Bank Stability: >90 percent stable

Width/Depth Ratio: <10, mean wetted width divided by mean depth

The East Face project will not immediately affect any of the RMOs with the implementation of Alternatives 2-5. However, in the long term (>20 years), this project could increase large woody debris in stream channels through pre-commercial thinning and by reducing the risk of high intensity fires. An increase in large wood could lead to an increase in pool frequency by providing a long term supply of large wood for stream channel structure. Precommercial thinning will increase stream shade by producing larger trees with fuller crowns.

2. Climate Change

A study conducted by Miles et al. (2000) within the Columbia River Basin, which includes the Snake River drainage, indicates that the consequence of climate change is higher flows during the winter and spring, and lower flows during the summer and fall. The tendency towards more precipitation and warmer temperatures during the winter implies substantially more rain, less snowpack accumulation, and therefore increased wintertime runoff. The decrease in snowpack accumulation, combined with lower

summertime temperatures and evapotranspiration lead to decreased summertime flows. The timing of flows is also altered. Peak spring flows tend to begin earlier compared to current runoff patterns.

The effects to Columbia River streamflow from simulated changes in climate are generally towards higher winter streamflow, reduced winter snow accumulation, and reduced spring and summer streamflow (Hamlet and Lettenmaier, 1999).

3. Compliance Statement

The East Face Project will not degrade water quality. Planning and application of BMPs will maintain or improve water quality. This includes monitoring of BMPs and effectiveness. None of the action alternatives will have an effect on stream temperature. With the exception of maintenance of closed roads, open and closed road reconstruction, culvert installation on closed roads, and culvert installation and removal on temporary roads, ground disturbing activities in the East Face project are away from streams and would not increase sediment delivery rates within the subwatersheds. RHCA treatments (that will benefit the RHCA) are restricted pre-commercial hand thinning, fuels reduction handwork, and hand piling and burning. A limited amount of draw bottom roads would be opened for project work in each action alternative. These temporary and closed roads will be properly closed (or maintained at an ML2 open road standard) after project activities are completed. Some amount of sediment will reach stream channels as a result of implementation of Alternative 2, 3, 4, or 5 but it will be short term in nature and occur only during project activities. The East Face Project is in accordance with the Clean Water Act and complies with the Clean Water Act requirements of the 1990 Forest Plan.

4. Floodplains, Executive Order 11988

Executive Order (EO) 11988 requires the Forest Service to “avoid to the extent possible the long and short term adverse impacts associated with the occupation or modification of floodplains.” The East Face Project is consistent with this EO because it does not propose to occupy or modify any floodplain.

5. Wetlands, Executive Order 11990

Executive Order (EO) 11990 requires the Forest Service to “avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands”. The East Face Project is consistent with this EO because it does not propose to destroy or modify any wetlands.

Appendix A - MONITORING

Pre-project monitoring for each Forest Management project includes on the ground survey of the project area and the proposed treatment units, survey of stream channels, RHCAs, slope stability, and general riparian vegetation characteristics. Post project monitoring will ensure that all Standards and Guidelines in the LRMP and use of best management practices are met through implementation of protection measures as identified by the interdisciplinary team.

Monitoring of the implementation of the project and protection measures will take place throughout the life of the project by the TSA and Watershed Specialist. For example, if an intense thunderstorm caused overland flow and subsequent excessive soil displacement or sediment production, harvest operations would cease until the soil moisture decreased or protection measures were complete. Potential effects from log haul on roads which parallel RHCAs will be monitored throughout the life of the project by the

TSA and Watershed Specialist. Timber harvest operations will be halted if adverse impacts are observed at any point during the operation.

Specific Constraints as Related to Fisheries and Watershed Concerns

This project must be designed in such a way that there will be a very low probability that there will be an adverse effect on fish species within and immediately downstream of the project area. Efforts should be made to reduce the existing sources of non-natural sediment. Large woody material must not be removed from stream channels. Existing protection measures should protect instream habitat needs such as stream cover, bank stability, and water temperature. Implementation guidelines below lists general management measures (Standards and Guidelines) that must be followed for all activities associated with this project.

Appendix B - IMPLEMENTATION GUIDELINES

No Activity Stream Buffers

PACFISH/INFISH RHCAs have been delineated on all streams adjacent to or within harvest units and precommercial thinning units. These PACFISH/INFISH RHCAs are delineated as follows: 300 feet on all fishbearing streams, 150 feet on non-fishbearing perennial streams and wetlands greater than one acre, and 100 feet on all non-fishbearing intermittent streams and wetlands less than one acre.

RHCA widths will be used as no activity stream buffers on all commercial removal treatment units, and other mechanical treatment units (slashbuster). For pre-commercial hand thinning, fuels reduction handwork, and hand piling and burning within RHCAs no activity buffers of 50 feet will be implemented on fishbearing streams (Class I), no activity buffers of 30 feet will be implemented on non-fishbearing perennial streams and wetlands greater than one acre (Class III), and no activity buffers of 10 feet will be implemented on non-fishbearing intermittent streams and wetlands less than one acre (Class IV).

Channel Stability

Maintain natural LWD and trees needed for future recruitment to protect or enhance stream channel and bank structure, enhance water quality, and provide structural fish habitat within all stream systems.

Stream Temperature

Prevent measurable (greater than $0.5^{o}F$ change) temperature increases in Class I streams. Temperatures on other streams may be increased only to the extent that water quality standards on downstream, fish bearing streams will not be affected. Normally stream shade management on Class III streams will differ little from treatment on Class I streams.

Sediment Yield

Design the project to minimize sediment delivery to stream channels.

Roads

Do not construct roads immediately adjacent to riparian areas. Any planned reconstruction or construction of roads crossing riparian areas will not alter stream or groundwater flow characteristics to the extent that it will impact the riparian area. Locate skid trails and roads to avoid paralleling stream channels in streamside management units. Roads will be managed to minimize impacts to water quality and fish and wildlife habitat. Design and maintain road drainage to prevent the influx of significant

amounts of road sediment runoff into streamcourses. Reduce road density within the planning area concentrating on drawbottom roads.

Log landings

Log landings will not be placed in riparian areas.

Skidding and Skid Trails

Skidding logs down stream courses or ephemeral draws will not occur. Locate skid trails to avoid paralleling stream channels. Ground disturbing activities will be normally limited to 10% exposed soil or less within riparian ecosystems. Minimize detrimental soil conditions with total acreage impacted (compaction, puddling, displacement, and severe burning) not to exceed 20% of the total acreage within the project area including landings and system roads.

REFERENCES

Agee, J. K. 1988. Wildfire in the Pacific Northwest: a brief history and implications for the future. *In:* Rieman, B., D. Lee. G. Chandler, and D. Myers. 1995. Does wildfire threaten extinction for salmonids? Responses of redband trout and bull trout following recent large fires on the Boise National Forest. Proceedings of Fire Effects on Rare and Endangered Species and Habitat Conference, November 13-16, 1995, Courd' Alene, Idaho.

Agee, J. K. 1998. The landscape ecology of western forest regimes. *In:* Pettit, N. E. and R. J. Naiman. 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems 10: 673-687.

Agee, J. K., C. S. Wright, N. Williamson, and M. H. Huff. 2002. Foliar moisture content of Pacific Northwest vegetation and its relation to wildland fire behavior. Forest Ecology and Management. 167 (2002): 57-66.

Anderson, P. G. 1996. Sediment generation from forestry operations and associated effects on aquatic ecosystems. Proceedings of the Forest-Fish Conference: Land Management Practices Affecting Aquatic Ecosystems, May 1-4, 1996, Calgary, Alberta.

Anderson, P. D., D. J. Larson, and S.S. Chan. 2007. Riparian buffer and density management influences on microclimate of young headwater forests of western Oregon. Forest Science 53 (2): 254-268.

Benda, L and T. Dunne. 1997a. In: Gomi, T., R. C. Sidle, and J. S. Richardson. 2002. Understanding processes and downstream linkages of headwater streams. Bioscience. Vol. 52 No. 10: 905-916.

Berg, D. R. 1995. Riparian silviculture system design and assessment in the Pacific Northwest Cascade Mountains, USA. Ecological Applications, 5(1), pp 87-96.

Binkley, D., and T. Brown. 1993. Forest practices as nonpoint sources of pollution in North America. *In:* Madrid, A., A. G. Fernald, T. T. Baker, and D. M. VanLeeuwen. 2006. Evaluation of silvicultural treatment effects on infiltration, runoff, sediment yield, and soil moisture in a mixed conifer New Mexico forest. Journal of Soil and Water Conservation. Vol 61 (3): 159-168.

Bozek, M. A., and M. K. Young. 1994. Fish mortality resulting from delayed effects of fire in the Greater Yellowstone ecosystem. *In:* Rieman, B., D. Lee. G. Chandler, and D. Myers. 1995. Does wildfire threaten extinction for salmonids? Responses of redband trout and bull trout following recent large fires on the Boise National Forest. Proceedings of Fire Effects on Rare and Endangered Species and Habitat Conference, November 13-16, 1995, Courd' Alene, Idaho.

Chan, S. S. Chan, Larson, D., and P. D. Anderson. 2004. Microclimate patterns associated with density management and riparian buffers. USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR

Danehy, R. J., and B. J. Kirpes. 2000. Relative humidity gradients across riparian areas in eastern Oregon and Washington forests. Northwest Science, Vol. 74, No. 3.

Debano, L. F., D. Neary, and P. Foolliett. 1998. Fires effect on ecosystems. 1998. *In:* Seymour, G. and A. Tecle. 2004. Impact of slash pile size and burning on ponderosa pine forest soil physical characteristics. Journal of the Arizona-Nevada Academy of Science 37(2): 74-82.

Decker, R. C. 2003. Current Regulations, Guidelines and Best Management Practices Concerning Forest Harvesting and Riparian Zone Management. Buffer Zone Working Group, Literature Review, July 2003. Fisheries and Oceans Canada, Environmental Sciences Section. St. John's, Newfoundland Canada.

Dwire, K. A. and J. B. Kaufman. 2003. Fire and riparian ecosystems in landscapes of the western USA. Forest Ecology and Management 178: 61-74.

Elliot, W.J., Robichaud, P.R. 2001. Comparing Erosion Risks from Forest Operations to Wildfire. *In:* Peter Schiess and Finn Krogstad, editors, Proceedings of The International Mountain Logging and 11th Pacific Northwest Skyline Symposium: 2001 - A Forest Engineering Odyssey. Seattle, WA: College of Forest Resources, University of Washington and International Union of Forestry Research Organizations. 78-89. Presented at The International Mountain Logging and 11th Pacific Northwest Skyline Symposium 2001, December 10--12, 2001, Seattle, WA.

Fiddler, Gary O., Dennis R. Hart, Philip M. McDonald, and Susan J. Frankel. 1995. *Silvicultural Practice (Commercial Thinning) Are Influencing the Health of Natural Pine Stands in Eastern California.* In Forest Health Through Silviculture. Proceedings of the 1995 National Silviculture Workshop. Rocky Mountain Forest and Range Experiment Station. General Technical Report. RM-GTR-267 pp. 208-212, 1995.

Foltz, R. B., K. A. Yanosek, and T. M. Brown. 2008. Sediment concentration and turbidity changes during culvert removals. Journal of Environmental Management 87(329-340).

Franklin, J. F., T. A. Spies, R. V. Pelt, A. B. Carey, D. A. Thornburgh, D. R. Berg, D. B. Lindenmayer, M. E. Harmon, W. S. Keeton, D. C. Shaw, K. Bible, and J. Chen. 2002. Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas fir forests as an example. *In:* Noss, R. F., J. F. Franklin, W. L. Baker, T. Schoennagel, and P. B. Moyle. 2006. Ecology and management of fire-prone forests of the western United States. Society for Conservation Biology, North American Section, Arlington, VA, August 2006.

Fule, P. Z, C. McHugh, T. A. Heinlein, and W. W. Covington. 2001. Potential Fire behavior is reduced following forest restoration treatments. USDA Forest Service Proceedings, RMRS-P-22.

Furniss, M. J., T. D. Roelofs and C. S. Yee. 1991. Road construction and maintenance. In: Influences of Forest and Rangeland Management on Salmonid Fishes and Their habitats; W. R. Meehan, ed. Pgs. 181-205. American Fisheries Society Special Publication 19. Bethseda, MD.

Gomi, T., R. C. Sidle, R. D. Woodsmith, and M. D. Bryant. 2003. Characteristics of channel steps and reach morphology in headwater streams, southeast Alaska. Geomorphology. 51: 225-242.

Graham, Russell T., A. E. Harvey, T. B. Jain, and J. R. Tonn. 1999. The effects of thinning and similar stand treatments on fire behavior in Western forests. Gen. Tech. Rep. PNW-GTR-463. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27 p.

Gregory, S. V., K. Boyer, and A. Gurnell. 2003. The ecology and management of wood in world rivers. *In:* Pettit, N. E. and R. J. Naiman. 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems 10: 673-687.

Gurnell, A., K. Tockner, P. Edwards, and G. Petts. 2005. Effects of deposited wood on biochemistry of river corridors. *In:* Pettit, N. E. and R. J. Naiman. 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems 10: 673-687.

Hamlet, F. A., and D. P. Lettenmaier. 1999. Effects of climate change on hydrology and water resources in the Columbia River Basin. Journal of the American Water Resources Association, Vol. 35(6):1597-1623.

Harmon, M. E., J. F. Franklin, and F. J. Swanson. 2004. Ecology of coarse woody debris in temperate ecosystems. Advances Ecological Reaserach34: *In:* Noss, R. F., J. F. Franklin, W. L. Baker, T. Schoennagel, and P. B. Moyle. 2006. Ecology and management of fire-prone forests of the western United States. Society for Conservation Biology, North American Section, Arlington, VA, August 2006.

Henjum, M. G. and seven co-authors. 1994. Interim protection for late successional forests, fisheries, and watersheds: National Forests east of the cascade crest, Oregon and Washington. *In:* Rieman, B., D. Lee. G. Chandler, and D. Myers. 1995. Does wildfire threaten extinction for salmonids? Responses of redband trout and bull trout following recent large fires on the Boise National Forest. Proceedings of Fire Effects on Rare and Endangered Species and Habitat Conference, November 13-16, 1995, Courd' Alene, Idaho.

Hey, R. D. 1979. In: Gomi, T., R. C. Sidle, and J. S. Richardson. 2002. Understanding processes and downstream linkages of headwater streams. Bioscience. Vol. 52 No. 10: 905-916.

Homyak, J. A., Harrison, D. J., and W. B. Krohn. 2004. Structural differences between pre-commercially thinned and unthinned conifer stands. Forest Ecology and Management, 194, 131-143.

Jakober, M. J. 2002. Sheep Creek culvert replacement sediment monitoring. *In:* Foltz, R. B., K. A. Yanosek, and T. M. Brown. 2007. Journal of Environmental Management. 87 (2008) 329-340.

Kalabokidis, K. D., and P. N. Omi. 1998. Reduction of fire hazard through thinning/residue disposal in the urban interface. Journal of Wildland Fire 8(1): 29-35.

Lakel, William A. III, Wallace M. Aust, M. Chad Bolding, C. Andrew Dolloff, Patrick Keyser, and Robert Feldt. 2010. Sediment trapping by streamside management zones of various widths after forest harvest and site preparation. Forest Science 56(6).

Lambert, Michael B. 1994. *Establish Stable Stand Structures And Increase Tree Growth: New Technologies In Silviculture. In* Volume 4: Restoration of Stressed Sites, and Processes. Pacific Northwest Research Station. General Technical Report. PNW-GTR-330. 123pp

Latterell, J. J., and R. J. Naiman. 2007. Sources and dynamics of large logs in a temperate floodplain river. *In:* Pettit, N. E. and R. J. Naiman. 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems 10: 673-687.

Luce, C. H. and T. A. Black. 2001. Effects of traffic and ditch maintenance on forest road sediment production. In proceedings of the Seventh Annual Federal Interagency Sedimentation Conference, March 25-29, 2001, Reno, Nevada. Pp V67-V74.

Madrid, A., A. G. Fernald, T. T. Baker, and D. M. VanLeeuwen. 2006. Evaluation of silvicultural treatment effects on infiltration, runoff, sediment yield, and soil moisture in a mixed conifer New Mexico forest. Journal of Soil and Water Conservation. Vol 61 (3): 159-168.

Maser, C., R. F. Tarant, J. M. Trappe, and J. F. Franklin. 1988. From the forest to the sea: a story of fallen trees. *In:* Noss, R. F., J. F. Franklin, W. L. Baker, T. Schoennagel, and P. B. Moyle. 2006. Ecology and management of fire-prone forests of the western United States. Society for Conservation Biology, North American Section, Arlington, VA, August 2006.

May, C. L.., and R. E. Gresswell. 2002. Processes and rates of sediment and wood accumulation in headwater streams of the Oregon Coast Range, USA. Earth Surface Processes and Landforms 28, 409-424.

McIver, J. 1998. Economics and Environmental Effects of Fuel Reduction at Limber Jim. In Technical Notes from the Blue Mountain Natural Resources Institute. BMNRI-TN-10. La Grande, OR.

Miles, E. L, A. K. Snover, A. F. Hamlet, B. Callahan, and D. Fluharty. 2000. Pacific Northwest Regional Assessment: The impacts of climate variability and climate change on the water resources of the Columbia River Basin. Journal of the American Water Resources Association, Vol. 36(2):399-420.

Moore, R. D., P. Sunderland, T. Gomi, A. Dhakal. 2005. Thermal regime of a headwater stream within a clearcut, coastal, British Columbia, Canada. *In:* Pettit, N. E. and R. J. Naiman. 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems 10: 673-687.

Nakamura, F., F. J. Swanson, and S.M Wondzell SM. 2000. In: Gomi, T., R. C. Sidle, and J. S. Richardson. 2002. Understanding processes and downstream linkages of headwater streams. Bioscience. Vol. 52 No. 10: 905-916.

Noss, R. F., J. F. Franklin, W. L. Baker, T. Schoennagel, and P. B. Moyle. 2006. Ecology and management of fire-prone forests of the western United States. Society for Conservation Biology, North American Section, Arlington, VA, August 2006.

Olson, D. L. 2000. Fire in riparian zones: a comparison of historical fire occurrence in riparian and upslope forests in the Blue Mountains and southern Cascades of Oregon. In: Beche, L. A., S. L. Stephens, and V. H. Resh. 2005. Effects of prescribed fire on a Sierra Nevada (California, USA) stream and its riparian zone. Forest Ecology Management. Vol. 218 (1-3) October, 2005: 37-59.

Olson, D. H., P. D. Anderson, C. A. Frissel, H. H. Welsh Jr., and D. F. Bradford. 2007. Biodiversity management approaches for stream-riparian areas: Perspectives for Pacific Northwest headwater forests, microclimates, and amphibians. Forest Ecology and Management.

Oregon Department of Fish and Wildlife. 2008. Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources. 12 p.

Pettit, N. E. and R. J. Naiman. 2005. Flood deposited wood debris and its contribution to heterogeneity and regeneration in a semi arid riparian landscape. *In:* Pettit, N. E. and R. J. Naiman. 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems 10: 673-687.

Pettit, N. E. and R. J. Naiman. 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems 10: 673-687.

Pothier, D. 2002. Twenty year results of pre-commercial thinning in a balsam fir stand. Forest Ecology Management. 168, 177-186.

Propst, D. l., J. A. Stefferud, and P. R. Turner. 1992. Conservation and status of Gila trout, *Oncorhynchus gilae*. *In:* Rieman, B., D. Lee. G. Chandler, and D. Myers. 1995. Does wildfire threaten extinction for salmonids? Responses of redband trout and bull trout following recent large fires on the Boise National Forest. Proceedings of Fire Effects on Rare and Endangered Species and Habitat Conference, November 13-16, 1995, Courd' Alene, Idaho.

Rashin, E. B., C. J. Clishe, A. T. Loch, and J. M. Bell. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. Journal of American Water Resources Association, October 2006, pp 1307-1327.

Reid, L. M., R. R. Ziemer, and Michael J. Furniss. 1994. What do we know about roads? Interdisciplinary and interagency workshop. Humboldt Interagency Watershed Analysis Center, McKinleyville, California, June, 1994.

Rentmeester, S. A. 2004. An assessment of large woody debris and riparian forest resources at Ellsworth Creek watershed and a comparison of riparian management options. MS. University of Washington, Seattle, WA.

Rieman, B., D. Lee. G. Chandler, and D. Myers. 1995. Does wildfire threaten extinction for salmonids? Responses of redband trout and bull trout following recent large fires on the Boise National Forest. Proceedings of Fire Effects on Rare and Endangered Species and Habitat Conference, November 13-16, 1995, Courd' Alene, Idaho.

Rinne, J. N. 1996. Southwestern wildfires: effects on fishes and aquatic macroinvertebrates and management implications. *In:* Rieman, B., D. Lee. G. Chandler, and D. Myers. 1995. Does wildfire threaten extinction for salmonids? Responses of redband trout and bull trout following recent large fires on the Boise National Forest. Proceedings of Fire Effects on Rare and Endangered Species and Habitat Conference, November 13-16, 1995, Courd' Alene, Idaho.

Robichaud, P. R., J. L. Beyers, and D. G. Neary. 2000. Evaluating the effectiveness of postfire rehabilitation treatments. Gen. Tech. Report. RMRS-GTR-63. Fort Collins: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 85 p.

Rosgen, D. 1996. Applied River Morphology. Wlidland Hydrology. Pagosa Springs, CO.

Rykken, J. J., S. S. Chan, and A. R. Moldenke. 2006. Headwater riparian microclimate patterns under alternative forest management treatments. Forest Science 53 (2): 270-280.

Seymour, G. and A. Tecle. 2004. Impact of slash pile size and burning on ponderosa pine forest soil physical characteristics. Journal of the Arizona-Nevada Academy of Science 37(2): 74-82.

Shakesby, R. A. and S. H. Doerr. 2006. Wildfire as a hydrological and geomorphical agent. *In:* Pettit, N. E. and R. J. Naiman. 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems 10: 673-687.

Swanson, F. J., and D. R. Berg. 1991. Ecological roots of new approaches to forestry. *In:* Berg, D. R. 1995. Riparian silviculture system design and assessment in the Pacific Northwest Cascade Mountains, USA. Ecological Applications, 5(1), pp 87-96.

Swift, L. W. Jr. 1984. Gravel and grass surfacing reduces soil loss from mountain roads. *In:* Grace, J. M, and B. D. Clinton. 2007. Protecting soil and water in Forest Road Management. American Society of Agricultural and Biological Engineers. Vol. 50(5): 1579-1584.

U.S. Fish and Wildlife Service. 1998. A framework to assist in making Endangered Species Act determinations of effect for individual or grouped actions at the bull trout subpopulation scale. February.

USDA Forest Service. 1990. Wallowa-Whitman National Forest Land and Resource Management Plan. Baker City, Oregon.

USDA and USDI. 1994. Environmental Assessment for the Implementation of Interim Strategies for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California. Washington, D.C.

Wilkerson, E., J. M. Hagan, D. Siegel, and A. A. Whitman. 2006. The effectiveness of different buffer widths for protecting headwater stream temperatures in Maine. Forest Science, 52(3):221-231.

Whittaker, J. G., 1987. Sediment transport in step-pool streams. In: Bathurst, J. C., Hey, R. D. (Eds.), sediment transport in Gravel-Bed Rivers. Wiley, New York, pp. 545-570.

Prepared by:

/s/ Sarah Brandy

_____

Sarah Brandy
District Fisheries Biologist